THE LANCHESTER MOTOR AND CARRIAGE.

Driving Manual.

THE LANCHESTER ENGINE CO., LTD.

The LANCHESTER MOTOR & CARRIAGE.

HIGHEST AWARD.

1399.

Part II.

DRIVING MANUAL.

Price Two Shillings.

The Lanchester Engine Co., Ltd.,
Armourer Mills, Sparkbrook,
Birmingham.

Driving Manual.

PREFACE.

In our present Driving Manual, which is primarily a book on the "Lanchester" Car, we have endeavoured to completely cover the ground so that should one of our cars fall into the hands of a man previously ignorant of its construction and handling, he would have no difficulty in rapidly familiarising himself with everything relating to its management.

In order to make the Manual as general as would be consistent with its primary function, we have, in the chapter on Motor Car Driving, treated the subject broadly, and have not confined ourselves to our own cars in particular.

We invite all users of our cars to assist us in making future editions of our Manual as complete as possible, by fully inquiring as to any points, either constructional or working, on which they may feel further information to be advantageous.

The present Manual forms the second part of our full Pocket Manual, which consists of three sections, as follows :—

"Descriptive Manual;"

"Driving Manual," containing full instructions for drivers' and attendants' use; and

"Engineer's Manual," containing full particulars of dismantling all portions of our car, for the use of engineering firms who are undertaking repairs or overhaul of our vehicles.

A certain amount of overlapping is unavoidable, as the three parts are published separately, and each is arranged as far as possible to be self-contained.

We request that all enquiries and communications of persons interested in understanding our machines, or wishing for a trial or to purchase, be addressed direct to the Company as below :—

THE LANCHESTER ENGINE CO., LTD.

ARMOURER MILLS,
SPARKBROOK,
BIRMINGHAM.

PART II.

Motor Car Driving.

INTRODUCTORY.

THERE is a prevalent idea amongst people who have had nothing to do with a motor car, that driving a car is an exception to the general rule of driving other vehicles, and that it consists in sitting on a box of mechanism and working a number of levers. If driving a car consists simply in starting from one point on an open road, and in course of time navigating the machine to some other stated point, there would be very little need for instructions on the subject, but no one can be counted a driver in any sense of the word whose whole capacity is summed up in this way.

Experience in horse-driving, bicycle riding, etc., is all of the utmost value to the would-be automobilist. Cycle riding especially is very valuable experience in the matter of judging speeds, distances, and traffic conditions. It is true that the speed of motor cars in general is much higher than that of bicycles, but the experience gained on a

bicycle is, all the same, of the greatest possible value in learning to handle a car. Distances and traffic conditions are met instinctively by an old cyclist or driver of a horse-drawn vehicle which would be a source of serious worry and distraction to anyone having no previous experience of the road.

This road experience cannot be given by any manual or treatise, and must be acquired by the individual entirely. There are, however, many points in connection with motor car driving, and especially learning to drive, that can be dealt with effectively by careful and accurate description. At present, the automobile world is in the "age of novices," so to speak, and a large proportion of the "tips" and hints which are given in motor papers are written by men who are just acquiring their first experiences, and though of some value as indicating the difficulties encountered, are frequently entirely inaccurate both as to suggestions given and theories advanced.

The instructions that have been prepared in the present manual for learning to drive, and hints on driving generally, have been compiled from the collective experience of men who have been motoring on the roads ever since, and even before, the Act of 1896, and

we believe that in every detail the information given can be absolutely relied on, though in some cases its application depends on the proficiency and capacity of individual drivers. In order that our manual may be of the maximum use possible, we have arranged the first portion of our instructions in a general form, which applies to driving any make of car; and this is followed by a careful description of the driving mechanism of the Lanchester Car, and then special notes as to the driving of a Lanchester. Many of the suggestions made under the heading of "Learning to Drive" might almost appear unnecessary, but we have found by experience that the human element varies so greatly that it would be difficult to write instructions and hints which were sufficient for one man without being too ample for another. While avoiding unnecessary and useless matter, we have embodied in the present manual notes and instructions which will, we think, be found to be more than sufficient for the generality of people.

On Learning to Drive.

FOR the first few times you take a car out, choose dry weather, or at least *dry roads.*

If you come to a wet patch on the road, go dead slow. Slow up before you get on to the wet or grease, and *not while on it.*

Drive quite slowly and cautiously until you have developed a steering instinct. (This usually requires some 30 or 40 miles in three or four instalments).

Choose at first roads for practice where traffic is scarce, and where all actions can be done with deliberation.

When you feel thoroughly proficient on dry roads, try a little practice in greasy weather.

When first experimenting in greasy weather, choose a wide road without traffic.

Remember the following :—

On a greasy road the control even a skilled driver can exercise on his machine is enormously diminished.

That any attempt to steer or brake too abruptly results in a "side-slip."

SIDE-SLIP. Side-slip is due to the surface of the road being separated from the surface of the tyre by a layer of greasy mud which acts as a lubricant.

The tendency to side-slip depends, under given conditions, entirely on the pressure on the tyre and the state of the road. The greater the pressure in a pneumatic tyre, the stiffer the mud on which it is most liable to skid. Thus, when the surface is worst for a motor car it is not so wet as when worst for a cycle (where the air pressure is lower).

The rear wheels are more liable to side-slip than the front.

The reason the rear wheels are more liable to side-slip than the front is that the brake or driving effort tends to retard on one hand or to skid the wheels on the other, and thereby destroys what adhesion they otherwise possess. A car will side-slip even on a dry day if the driving wheels are "scotched" by too powerful application of the brake.

A bad side-slip is apparent to the merest novice by the uncanny sideways motion of the rear portion of the car.

It can be arrested if taken in time by withdrawing clutch or brake and allowing car to run free.

If side-slip is due to taking a corner too sharply, it can be prevented by relaxing the steering effort somewhat.

A novice should remember that if a side-slip occurs when it is impossible to relax either brake or steering, as in a tight place in traffic, a collision may be inevitable. The *only* way for a novice to keep out of difficulty with a pneumatic or rubber-tyred car amongst traffic in greasy weather is to *go slow* and take no risks.

With an open road a skilled driver will frequently drive through grease with apparently as much ease as if on a dry road. This is because he has schooled himself to feel and correct a side-slip before it is perceptible to a novice.

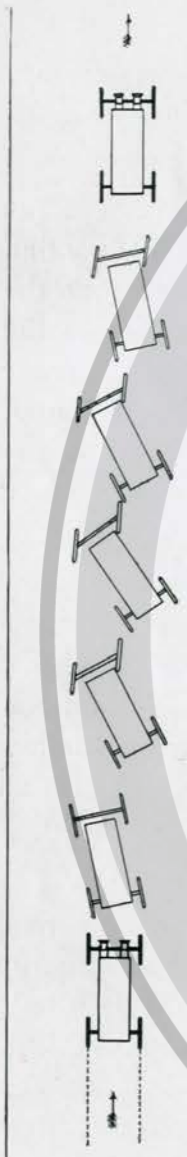
A driver on an open, greasy road, to correct a side-slip, must humour his car by

steering in the same direction as the side-slip, so as to keep his car in track, so to speak.

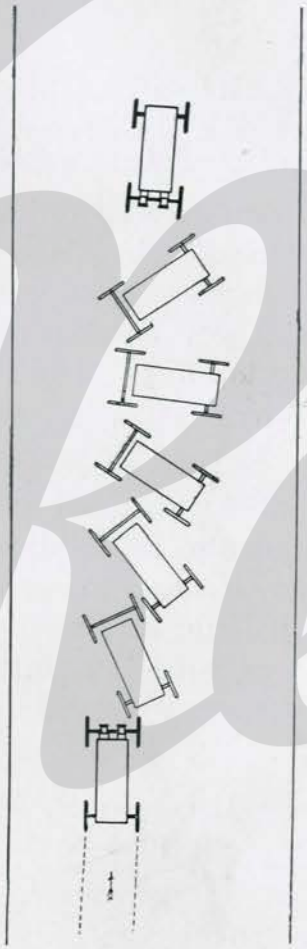
If he allows the side-slip to go too far (as a novice is somewhat liable to do) he may find his car moving so much sideways that the steering wheels thrown right over on to the "lock" fail to fetch the car straight. A car under these conditions will swing right round, side on, and then backwards and round again, if the initial speed is sufficient to carry it on (Figs. 31 and 32).

A good driver will always correct a side-slip in its infancy, and if it shows any tendency to increase in spite of "humouring" the car, he will immediately withdraw the clutch or brake. This effects an immediate cure.

It very rarely happens on an open road that the clutch or brake cannot be temporarily withdrawn to check a side-slip, and this only occurs on a very steep up or down gradient. A novice will do well to bear in mind that a very steep up or down gradient is a particularly difficult thing to negotiate in greasy weather, especially if the road *slopes sideways*



SIDE-SLIP.
CORRECTED IN TIME.
Fig. 31.



A BAD SIDE-SLIP.
DRIVER LOSES CONTROL.
Fig. 32.

as well; and that there are many hills that present no serious obstacle in dry weather, but are *absolutely impassable* when in a greasy state, even to an old hand.

The greasiness to which a road is liable varies according to the material of which it is composed.

The worst offenders are :—

IN TOWNS.

Asphalt pavement.
Wood pavement.
Granite or rag setts.
Tram routes.

IN THE OPEN COUNTRY.

Roads in chalk districts.
Roads in oolitic limestone districts.
Roads with a clay surface.

N.B.—Hard-frozen ground or dry ice is quite safe. A frozen surface may, however, become very treacherous should a thaw set in, or rainfall take place, quite irrespectively of the nature of the natural road surface.

Front wheel slip is comparatively rare, but sometimes happens when driving too fast on a very greasy surface, or in tramlines when a sudden steering effort is made. To a novice the feeling is as if the steering fails to act.

DRIVING IN GREASY WEATHER.

A few further suggestions as to driving in town in *greasy weather* may be added, viz. :—

In starting or stopping, especially the latter, on the "camber" of the road, care must be taken in easing in clutch or brake. If done too brusquely, the driving wheel may side-slip with violence against the kerb, and may injure tyre or wheel, or bend an axle.

It is a good plan to give the kerb a wide berth in greasy weather, and stop two or three feet clear if there is a heavy camber on road.

A skilled driver will never, under any circumstances, collide with a kerb broadside on. If necessary, he will exaggerate a side-slip sufficiently to negotiate the kerb backwards rather than risk the consequences of lesser side-slip which will result in broadside collision.

When a knot of traffic requires much steering to get through, slow up as much as necessary as a preparatory measure, so that the brake is not required to be on when steering round obstacles.

The same caution applies to passing a vehicle on a road with much camber, when it is necessary to get on to the side of the road. Apply the brake, if required, whilst on the crown of the road. Then steer round obstacle with neither brake or clutch in, and only put in clutch when again on even ground.

Remember that whatever the state of the road, it is *bad driving* to navigate the car *sideways*.

CONDITIONS ON WHICH SIDE-SLIP DEPENDS.

As far as the tendency to actual commencement of a side-slip is concerned, it has been said that it depends solely on pressure in tyre (that is, per square inch between tyre and ground) and state of road.

The differences of behaviour between cars similarly shod and of similar weight are, however, marked. This will be understood from the following remarks :—

Long wheel-base cars are more easily managed than short. They swing slower, and give the driver more time to act.

A car with a big steering range or large angle of lock is better than one with only a

small angle, as it is less liable to get hopelessly out of control. It has to get round

further before it is out of the driver's power to pull it back.

A car with a "nimble" form of steering is the easiest to manage (in favour of side lever *versus* wheel).

A car that will "coast" freely is better than one that has much dead friction.

A proper balance of weight on front and rear wheels.

If too little weight on front wheels, a car is liable to fail to take any notice of any sudden call on its steering gear, owing to front wheel slip taking place. Too little weight on driving wheels makes a car more liable to side-slip when either clutch or brake are in.

Two other points are worth noting. A smooth-working clutch and brake that can be handled to a nicety are a *sine quâ non* in greasy weather. Also, a car whose differential is stiff is very disagreeable to drive, as it renders a car peculiarly susceptible to side-slip when turning corners.

Manœuvring.

It often happens that in getting into and out of a coach-house, turning round in narrow and crowded thoroughfares, etc., careful manœuvring is necessary in order to take up or arrive at the desired position. Most drivers can, with reasonable space, succeed in executing any given manœuvre, but to do so in a workmanlike way—that is to say, to bring about the required change of position of the car in the fewest shunts possible—requires a certain amount of practice, but principally that the driver shall understand what he is doing. There is a considerable difference of appearance, for instance, in turning round in a narrow thoroughfare, between coming round with a single reversal of motion of the car, and taking two reversals to do the manœuvre. In the first case the driver starts by backing his car and steering it round till at right angles to the thoroughfare, and then starting off straight away with his forward gear (Fig. 33).

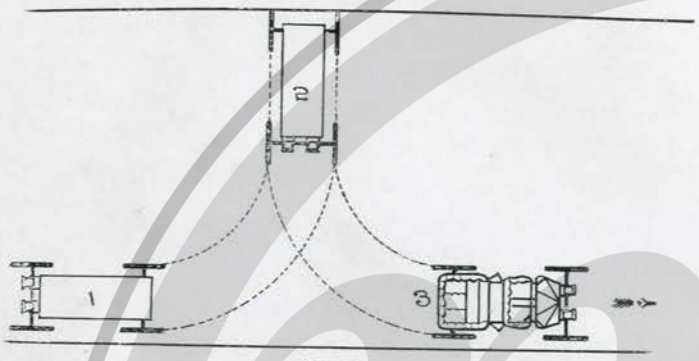


Fig. 33.

In the second, the driver first goes forward till at right angles to the thoroughfare, then reverses till his car points in the direction in which he wants to go, and then has to again go forward in order to complete the manœuvre (Fig. 34). Anyone will see what a much neater method of turning the first is than the second, by reference to the figures.

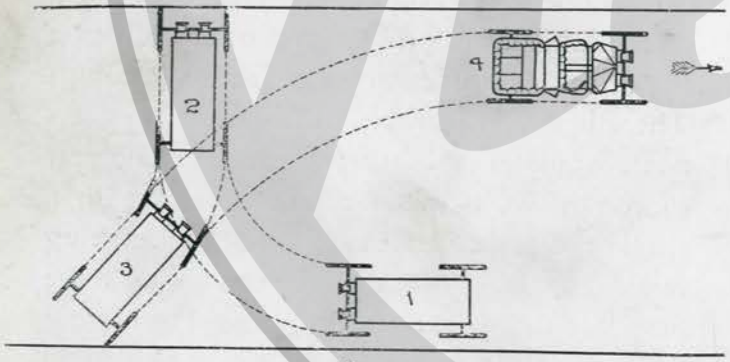


Fig. 34.

A few typical cases are given in Figs. 35, 36, and 37 of manœuvres which are frequently

in request. Fig. 35 shows a car being turned about the centre of its rear axle. This may be called "pivoting about on rear centre."

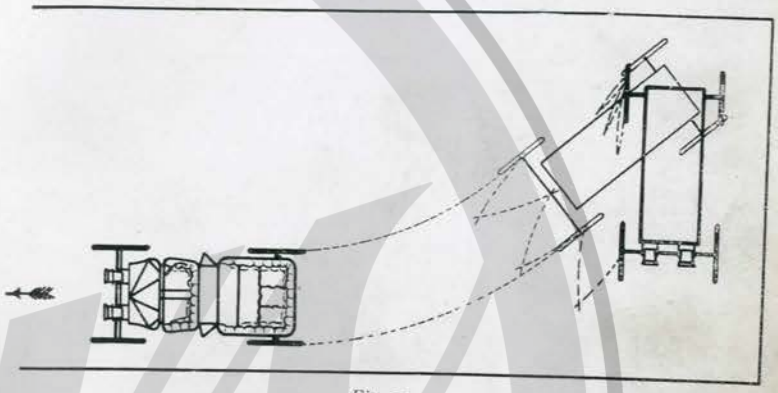


Fig. 35.

Fig. 36 shows a similar but more tedious manœuvre of "pivoting about on front

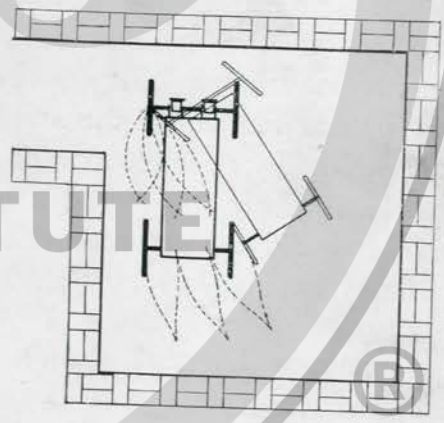


Fig. 36.

centre." Fig. 37 shows how a car may be manœuvred sideways. In the figures, a

suggestion is shown of surrounding obstacles such as might be encountered, and the traces of the wheel tracks are indicated by dotted lines in such a way as can easily be followed.

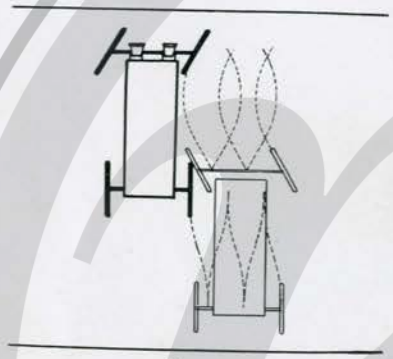


Fig. 37.

It will be noted that whereas "pivoting about on rear centre" requires only one motion of the steering gear at each shunt, the other two movements—Figs. 36 and 37—require a double motion of the steering for each backward and forward motion of the car, it should consequently always be the object of the driver to avoid the second and third of these manœuvres (Figs. 36 and 37).

It sometimes happens, however, that these more tedious manœuvres are required, though perhaps not so extensively as illustrated in the figures, and it is important on these occasions that a driver should know

exactly how to handle his machine. Careful study of the figures, and a little practice, will give any novice who takes an interest in his driving the power to handle his machine effectively in difficult positions.

In Conclusion.

Briefly it may be remarked that as far as actual driving goes, the skill required to drive a car well at ordinary touring speeds on a dry road is not great. A considerable amount of practice, however, is necessary to obtain a sufficiently accurate judgment in matters of traffic to be able to get the best results out of a car. On the contrary, in greasy weather the proper manipulation of a car gives an opening for the exercise of skill of a very high order, and unless a driver knows his machine he requires to exercise considerable caution.

To the most cautious driver a sudden emergency is sometimes likely to occur, and only experience will enable him, when taken by surprise, to do the right thing at the right time.

The Lanchester Car.

Driving Mechanism Described.

THE driving mechanism will be described under the following headings :—

Steering.
Motor Control.
Change Gears and Speed Control.
Motor Starting Mechanism.

STEERING. A general arrangement of the steering mechanism will be gathered by reference to Figs. 38 and 39, which show the position of the road wheels and side lever on the left and right hand lock respectively.

It will be noticed that the steering wheels are operated by moving the lever handle about a centre which approximately corresponds to the driver's elbow, either to the right or left hand, the direction corresponding to the direction in which it is required to steer the car.

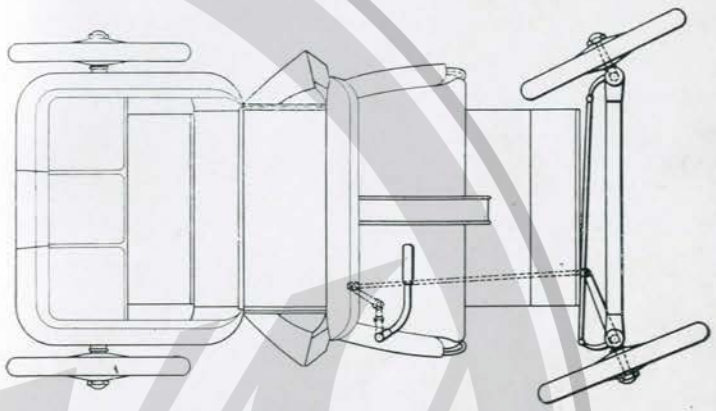


Fig. 38.

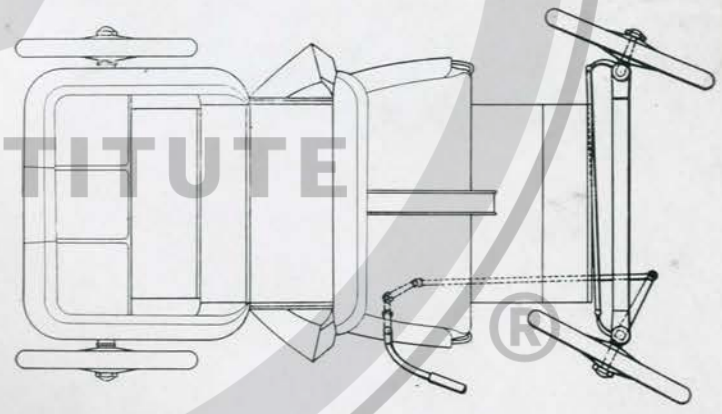


Fig. 39.

CAR CONTROL.

The controlling mechanism of the car, other than steering, is mostly situated between the driver's seat and the front passenger's seat, and is illustrated in Fig. 40, in which the various parts are named.

Fig. 40.

MOTOR CONTROL: MIXTURE.

The regulation of the supply of mixture to the engine is placed under the control of the driver, the carburetted air drawn from the vaporiser being mixed with fresh air through a direct inlet by a mixture tap termed the vapour regulator, shown in Fig. 41. The visible portion of this consists of a handle and quadrant.

The quadrant is numbered from 1 to 7 for the purpose of convenience in identifying the correct position of the handle. In order to stop the engine the vapour regulator is turned to zero, in which position it admits air only to the motor cylinder. In the opposite extreme position the whole of the air drawn in by the motor passes through the vaporiser and is thereby carburetted. This is the position in

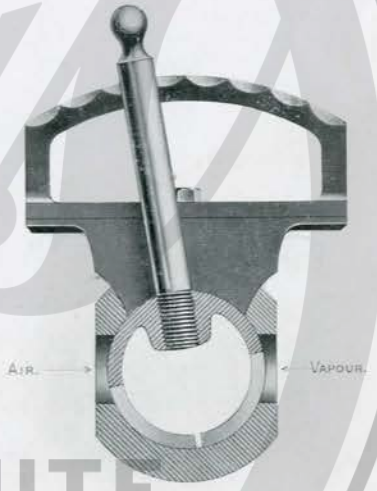


Fig. 41.

which the engine runs best in very cold weather, or when the supply of petrol is nearly exhausted.

The usual running position is somewhere intermediate between about 2 and 6, and is very constant under given conditions, but will change with variations of the gravity of the

petrol used and with the general temperature of the air. It will be seen on reference to Fig. 41 that a single cylindrical plug is arranged to cut off the vapour on the one side as it opens to the air on the other.

MOTOR CONTROL: SPEED REGULATION.

The motor speed regulation is controlled by two separate appliances—the governors operated by hand, and the accelerator operated by a foot pedal. The governors are illustrated in Fig. 42. The operating mechanism consists of two small hand levers, the position of which is shown clearly in Fig. 40. Referring to Fig. 42, the hand levers operate two snail-shaped notched cams which in turn operate the governor actuating levers, the arrangement of which is clearly indicated.

Fig. 42

These two levers act independently on the two governor springs which control respectively

Fig. 43.

the admission valves of the right and left hand cylinders. It will be noticed that the two sets of governor mechanism are independent, so that the driver is enabled either to regulate the two cylinders to do equal amounts of work, or to suppress either one or the other of them at will.

The accelerator mechanism illustrated in Fig. 43 performs a similar function to the governor mechanism. The difference is that whereas the governors are arranged to act independently, the accelerator acts on both cylinders simultaneously. Referring to Fig. 43, the normal position of the pedal is shown in solid line, the dotted position being that when the accelerator is depressed by the driver, causing a tension on both accelerator springs acting on the governor tumblers and thereby increasing the speed of the motor in precisely the same way as is done by the governor springs themselves. The governors and accelerator are used by the driver in conjunction, the accelerator being used to vary the speed of the motor as required, while the governors are used to enable the driver to have control of the working of the cylinders independently and to be able to adjust the working of the engine, so that when the accelerator is depressed both the

cylinders come into operation together. The governors can also be used by placing both levers in the backmost position to permanently increase the speed of the engine when driving in open country, and thereby avoid the constant use of the accelerator.

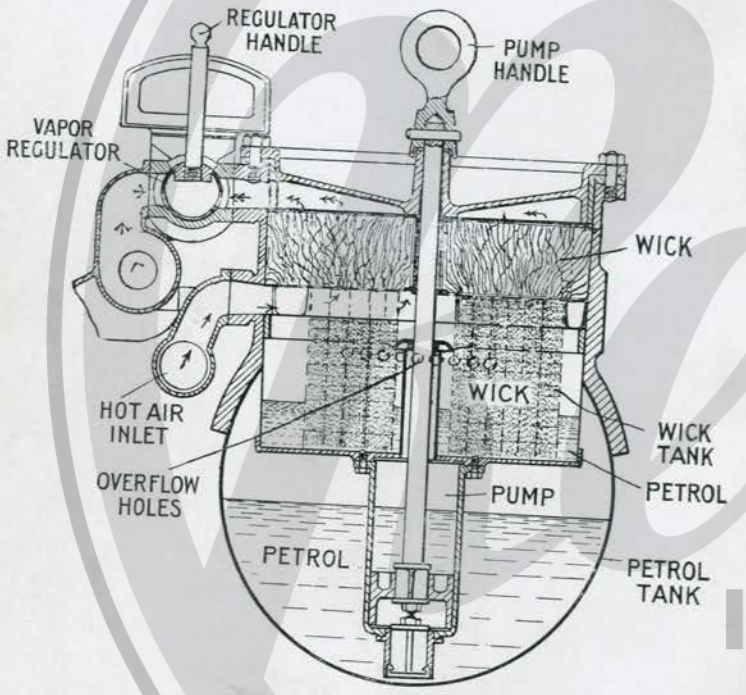


Fig. 18.

THE PUMP. The pump is employed to replenish the supply of petroleum spirit in the vaporiser tank. This is shown in full section in Fig. 18 of the Descriptive Manual, reproduced here. The

wick tank is filled from the main tank by about eight or ten strokes from the pump, any overflow passing back into the main tank.

CHANGE GEARS AND SPEED CONTROL. The high and low speed levers actuate respectively a direct clutch and brake, and the change speeds and reverse. Both these levers are arranged to work with pawls and notched quadrants, and each is idle in its central position. The central position is furnished with a wide notch, allowing considerable backlash, so that the driver can feel at once that the lever is correctly centred without looking down.

The high speed lever applies the main brake in a backward position, and engages a direct friction clutch in the forward position. Two series of notches are provided for the clutch and brake respectively.

The low speed lever applies a separate brake in its backward position, its functions being exactly similar to those of the high speed lever The brake drum operated by the low speed lever is arranged to act through the medium of gears, and after bringing the car to rest, this brake further acts as a reversing gear. No notches are provided on the reversing portion of the low speed quadrant, as it

is undesirable that the reversing gear should be notched in. The low speed lever in its forward position has two distinct actions, and these are under the control of the small lever (Fig. 40), called the "Change Gear Trigger." When this trigger is in the position shown in the figure, the low speed lever in its forward position gives the lowest gear of all, which is approximately a quarter of the speed of the high gear. When the change gear trigger is thrown over towards the vapour regulator into its extreme position, then the low speed lever when forward gives the intermediate or "compound" gear. This gear is termed the "compound" gear, owing to the fact that two sets of epicyclic gear are compounded to produce an intermediate speed. In order that the action of this gear change may be clearly understood a diagrammatic view is shown in Fig. 44, the parts being labelled to which reference has been made. The figure is to a certain extent self-explanatory, and it will be seen that the alternative pawl which acts on two actuating links of the two-speed gears is under the direct control of the change gear trigger.

One advantage of this form of change gear is that the change of gears may be signalled by the trigger while either of the other gears are actually in use, the actual

DIAGRAMMATIC VIEW OF CHANGE GEAR MECHANISM.

Fig. 44.

change of gear being effected by a quick withdrawal of the low speed lever and its replacement in gear. When the change gear trigger is used in this way, the spring in the spring box is compressed, and the moment the gear which happens to be in use is thrown out, the alternative pawl is released and springs over, so that when the low speed lever is again used, the change of gear has been effected automatically.

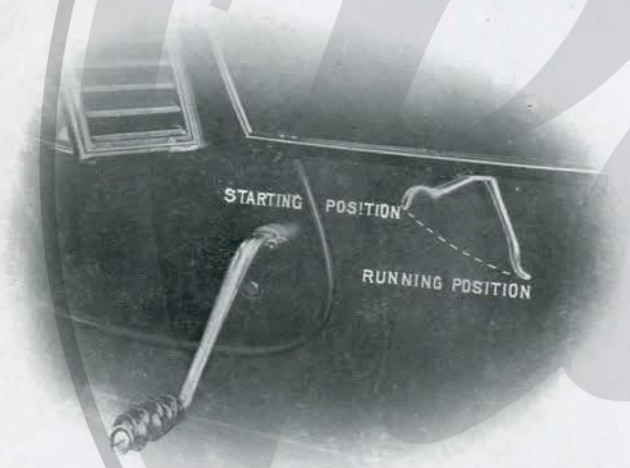


Fig. 45.

MOTOR STARTING MECHANISM.

The external or visible arrangements provided for starting the motor are given in Fig. 45. The relief lever shown in the starting and running positions in this figure

fulfils several functions. It not only brings the relief compression cams into operation, but retards the ignition till after the dead centre, at the same time moving the armature of the magneto generator into a new position corresponding to the delayed ignition It also engages and disengages the starting shaft to which the starting handle is coupled.

By this one lever it will be seen that not only are all the changes necessary to starting the motor effected at one operation, but the whole arrangement constitutes a safety device by which it is impossible for the person starting the engine to receive a back ignition. The starting shaft is idle, and not in gear with the motor, unless the relief lever is put into the starting position.

N.B.—Before endeavouring to start a motor, see that the speed levers are in their correct positions, that is to say, the high speed lever well back in the brake position, and the low speed lever central.

Driving a Lanchester.

STARTING ENGINE.

The engine is arranged to be set in motion with the customary starting handle. First turn on the mixture at the vapour regulator, give a

few strokes of the pump and put the governor levers back a few notches. Then put the handle in position, in gear with the starting shaft, and pull up the relief lever, causing starting shaft to gear with the motor. Turn the starting handle a little when raising the relief lever to facilitate the meshing of the gears (compare page 102, "Driving Mechanism Described)." A few turns of the handle (clockwise) will thenstart the engine.

The first few turns of the starting handle serve to empty the vapour pipes of air and introduce the charge of mixture into the cylinders, and there is no advantage in taking these first few turns other than leisurely. A couple of rapid turns will then effect a start, provided that the vapour regulator is properly adjusted. The preliminary turns of the motor in order to charge the feed pipes may be avoided if the vapour regulator is turned on a few minutes before starting. In this way the engine may be started with a single turn of the handle.

When putting up the car for the night, or any length of time, it is as well to give a few strokes of the pump. This facilitates re-starting, especially when the weather is cold or the petrol stale.

The arrangement of the starting mechanism fitted to the Lanchester Cars prevents any possibility of a "back-fire" taking place, as the starting shaft is not geared with the motor unless the relief shaft is raised, and the relief lever automatically retards the ignition till after the dead centre.

To avoid any chance of the starting handle seizing in its shaft when the engine gets away, it is desirable to lubricate the end of the starting handle, or the hole in the starting shaft, with a little oil or grease occasionally. A driver should look to see that this has been done before attempting to start. Should this attention be neglected it is possible for the starting handle to seize and be carried round by the starting shaft when the motor gets away. Should this happen, the proper course is to at once depress the relief lever. (Under the circumstances this is best done with the foot.) A starting handle seizure is entirely due to neglect to lubricate.

It is found best to have the compressions on up stroke (of the starting handle) in starting, and should it be found on turning the handle that the compressions are on the down stroke, the handle may be backed half a turn and remeshed in the opposite position. Should one of the

compressions still be on the down stroke, the relief lever should be lowered and the gear remeshed in another position. The advantage of feeling the compressions on the up stroke is that if the engine gets away very suddenly there is no shock on the hand.

Having started the engine, see that the vapour is properly regulated. This can be effected at once by depressing the accelerator and noticing whether the engine races away immediately. If the engine is slow in picking up, try a change in the mixture one way or the other. When the mixture is right, the motor should get away rapidly on depressing the accelerator, or to a lesser extent on putting up either one or the other of the governor levers. If there is any doubt about the proper running of the engine, it is always best to try putting back the governor levers separately and noticing that the engine gets away properly and does not misfire on either cylinder. When the mixture is properly regulated, it does not generally require altering, although frequently readjustment after running a few miles is found desirable.

DRIVING.

A car may be started on any of its three speeds. On a considerable down gradient the brake may be removed and the car allowed to

glide away, and the high gear put in as soon as the car is fairly in motion. On a level or slight up grade, either low gear or compound gear may be used for starting, at the driver's option. On a heavy up grade it may be necessary to use the low gear before putting in the compound. *Do not forget to take off the brake.*

It will be sufficient to describe exactly how a car should be started on a steep up grade. Starting under easier circumstances presents no difficulty.

When starting on an uphill grade the low gear should always be used to get under weigh. Throw the change trigger (Figs. 40 and 44) into the forward position, un-notching the brake, and rapidly (before the car has had time to slide backwards perceptibly) push the low gear lever forward, having just previously depressed the accelerator pedal. If the accelerator pedal is not used and the low gear lever is put in too abruptly, the result may be that the engine will be stopped. The same may occur if the vapour has not been properly regulated at starting.

When the car is thoroughly under weigh on the low gear, the change trigger should be put in to its backmost position. The low

gear lever is then rapidly drawn back and replaced in its forward position. A click will be heard on withdrawing the low gear lever, which denotes the moment of the gear change, and it will be found on re-notching the low gear lever that the compound gear is now in action in place of the low gear. When the car has gathered sufficient speed, if the gradient will permit the low gear lever may be withdrawn and the high gear used.

When changing gears on an adverse gradient it is well to use the accelerator while the gear is being changed. When, however, it is on a level or down grade, it is not necessary to use the accelerator excepting simultaneously with the new gear being employed. It is a matter of a little experience and practice to learn to work the accelerator and gears in accord. On the one hand, racing the engine without any gears in action must be avoided ; and on the other, the speed must not be allowed to fall too low during a change of gear ascending a steep hill.

When starting a car on an extremely bad gradient, such as 1 in 5 or 1 in 6, a car can accumulate quite an appreciable backward velocity between the time at which the brake can be taken off and the low gear can be put in. The neatest method of starting on a

gradient of this sort, which needless to say is uncommon, is to ignore the steering while getting under weigh, withdraw the brake with the right hand, and put the low gear in with the left simultaneously.

Our system of changing gears, which will be clearly understood by anyone reading our Descriptive and Driving Manuals, is one having considerable advantages over the ordinary French type of change gears. It is quite easy for a novice to operate our change gears without a serious risk of doing any harm, and should the gears be changed with the speeds of the motor or car being relatively unsuitable, the action is perfectly smooth—there is none of the jarring associated with gears that have to be intermeshed when running at different velocities.

The most difficult time to change gears is when climbing a hill, and it is then that a mistake causes the most inconvenience. On our system there is no possibility of "missing your gear." The gears are always in mesh, and the operating mechanism is a metal on metal brake. There is one very great advantage in our system of changing between the low and second or "compound" gear. This is the facility and rapidity with

which the change can be made. A very effective plan in getting away rapidly under adverse conditions on a Lanchester Car is to place the low gear lever in a slightly forward position, but not sufficiently to engage, having first put the change gear trigger in its forward position. Then throw the change gear into its backward position. Now the low speed lever may be put in and then withdrawn and replaced, giving successively the low and compound gears without any intermediate operation.

In driving, the motor speed regulation and clutch lever require to be operated in harmony. When the clutch is withdrawn for coasting, the motor speed should immediately be dropped. When, in order to slow the car down in traffic, the motor speed is dropped, and it becomes possible to detect the impulses of the engine, the clutch should be slightly eased so as to allow it to slip sufficiently to obliterate the effect of the intermittence of the impulses. The clutch requires to be manipulated in this way when the car is travelling at less than about 12 or 14 miles per hour on the high gear or at higher speeds on high-geared machines.

When driving in town, whenever nearing cross roads, it is a good plan to withdraw the

clutch and allow the car to coast for some considerable distance. As soon as the driver can see that the road is clear he drops his foot on the accelerator pedal and slips in the clutch again.

By driving in this manner, many an emergency stop is avoided, the brake is used less and the petrol consumption is less, while the average speed and safety are greater than by driving with the clutch constantly in.

On no account should the *speed of the engine* be regulated by *altering the mixture* from the position at which the engine gives the maximum power. This is the most prevalent cause of overheating.

The petrol pump should be used fairly frequently when the engine is running to ensure the vaporiser tank being kept filled. The pump should not be used too vigorously or the engine will momentarily "flood." So long as the pump is used gently this will not occur. If the engine commences to slow or lose power when the pump is used, the mixture should be cut down temporarily, until it has recovered itself.

The object of the independent governor levers for regulating the speed of the engine in addition to the accelerator is two-fold.

Firstly, when in open country, the governor levers can both be put up to any desired position, and the necessity of keeping the driver's foot on the accelerator pedal avoided. Secondly, any differences in the setting of the two governors can be corrected by the governor operating levers being put independently into different positions. These levers are not intended to be always worked level. If they were, they would be made in one piece. They are intended to act as a ready means of adjustment for the driver to be able to ensure his two cylinders taking each its fair share of the work, and to be able to adjust, if he wishes, so that one cylinder can be put out of action altogether.

STEERING. The side lever system of steering, as fitted to our cars, is the most automatic form of steering known. Anyone having no previous experience of steering at all is able to steer our cars

without difficulty, and at once finds the action nearly automatic.

Our side lever, it will be noticed, works the reverse way to the tiller of a boat, and this is the correct way for the steering of a motor car. A lever arranged to steer like the tiller of a boat is unstable and dangerous, whereas, with the motion the reverse way, it is perfectly stable and the safest form of steering at present devised. Even yachtsmen, who are thoroughly used to steering small craft, have no difficulty in handling one of our cars, and the steering becomes quite automatic to them after a few trials, although just at first they are not quite so comfortable as a person who has never handled a tiller at all.

A Lanchester Car tends always to steer in smooth curves, and to over-steer is almost a physical impossibility, owing to the centrifugal force acting on the driver's body tending to moderate his steering effort.

The first thing a driver will note when he commences to steer is that the car tends to "pull towards the gutter"; that is to say, tends to take a downhill direction. It is this "pull" which renders a car safe in steering, and is caused by the slight "rake" given to the steering heads. This "rake" may be varied by the upper links of the front suspension, but it is adjusted at the works, before

being sent out, to the amount which experience has shown to be most advantageous. Until the driver is accustomed, he is at first liable, if he takes his attention off the steering, to run towards the side of the road ; that is to say, he forgets to steer, and it is until he has overcome this tendency to forget to steer that he should not try and travel at too high a speed. The reason that the "pull" of the steering gives safety is that, in turning a corner, the pull of a car always tends to prevent the driver from taking too sharp a curve, and it is absolutely essential to have a steering that pulls in this manner if one wishes to be able to steer with any sense of security at night time. The experienced driver steers by applying pressure in the direction in which he wishes to go, and increasing the pressure as he may wish to turn sharper, and decrease to turn less rapidly. A novice usually endeavours to steer as if the machine were a traction engine ; that is to say, by a definite motion of the tiller instead of by pressure.

The proper way to handle the steering at high speeds is to lean inwards in rounding a corner or bend in the road, as if riding a bicycle, and *take the lever with you*. Steering in this way, the car and driver seem to form part of one whole.

Choice of Gear.

It is as well for a driver not to learn on too high a geared machine. The higher the gear used, the greater is the difference that manifests itself between a beginner and an experienced driver, and it is quite a simple and inexpensive matter to have the gear increased after the car has been in use for a month or so.

When driving with a high gear it is necessary to take every advantage of the road, and the average speed that can be attained by a man who knows the road is much higher than that of a man who does not. In the hands of an experienced driver, a high-geared car will very often appear a better hill climber than a low-geared machine of the same power.

In practice the extent to which this is the case is quite surprising, especially on a switchback road. Naturally on a long, severe climb, a low-geared machine shows to advantage.

How to Side-slip.

The Lanchester Car is a particularly easy car to handle in greasy weather. The long wheel-base and side lever steering, coupled with a wide angle of lock, render its behaviour very consistent on greasy roads.

Every type of car requires a certain amount of learning before the driver feels quite at home on grease, and perhaps the best way to learn how *not* to side-slip is to learn "how *to* side-slip."

The Lanchester Car may be handled quite safely in a way that is not possible with cars with a high centre of gravity and narrower wheel gauge, and the following illustrations of what can be done in the way of grease evolutions by a skilled driver will serve both to assist and interest those who are not acquainted with the precision with which a car can be handled under adverse conditions.

Fig. 46 shows a very easy manœuvre on a road that is sufficiently wet and greasy. Starting from a position alongside the road, with the wheels practically against the kerb, the car may be turned completely round in place, as shown by the successive positions

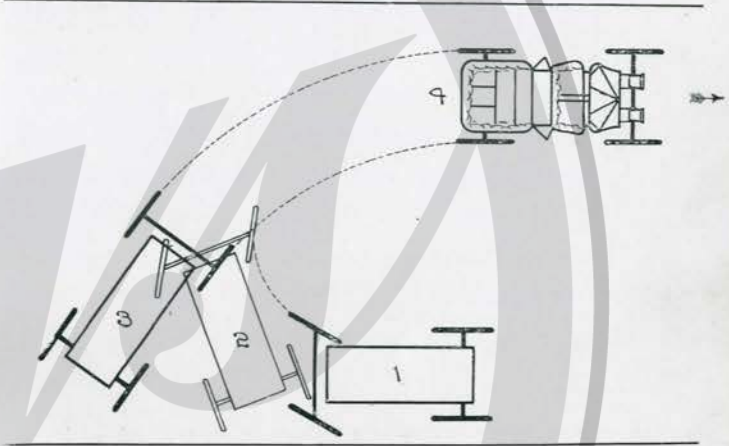


Fig. 46.

figured. To carry out this manœuvre, set the steering towards the centre of the road as if about to turn in the usual way (Position 1). Start the car brusquely with such a gear as can be taken without stopping the motor (the compound gear will generally be found most suitable). The driving wheels will immediately commence to skid, and driving at the same time the car will take up the successive positions as shown. A car can be readily

turned much more handily in this way than is possible at all on a dry road. The only point to note is that the car should be either quite close against the kerb or well away from it. Otherwise there is danger of hitting the kerb sideways and bending an axle.

Fig. 47 shows how a car may be thrown completely round at stopping, ready to start again on the return journey. This is very easy to do, but requires good nerve and fine judgment to get the car into the position wanted. It should on no account be attempted in the presence of other traffic even by a proficient, as it is a performance that is thoroughly disconcerting to other users of the road. To

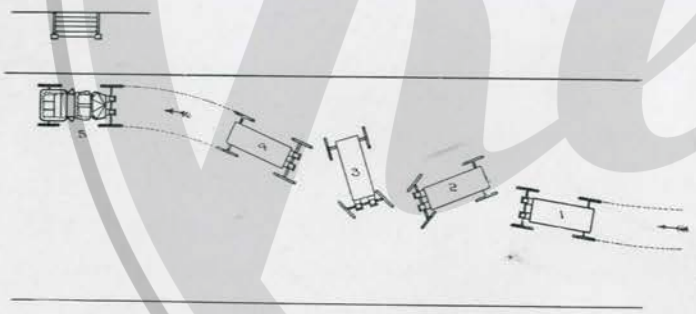


Fig. 47.

throw the car completely round in this way, the brake should be applied strongly, and the car steered violently at the same time. The speed should be about six to ten miles an hour.

Fig. 48 illustrates a variation of this manœuvre, which may be termed "a sideways stop." It is a manœuvre which is very difficult to judge and execute with accuracy, and can only be done with certainty by an expert driver. The car may be brought up in this way in greasy weather in about half the

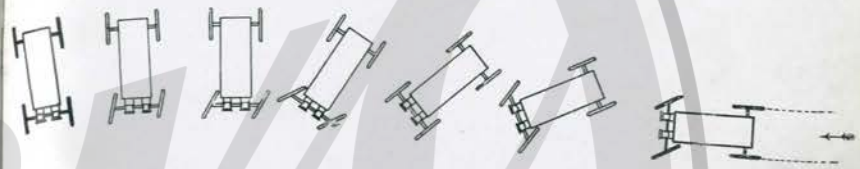


Fig. 48.

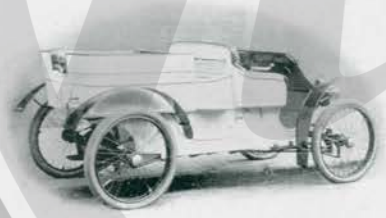
distance that is possible when only the adhesion of the driving wheels is employed by using the brake in the ordinary way. This manœuvre is learned by practising the swing-round stop, as in Fig. 47.

The above examples are given of what a really expert driver can do with a Lanchester car on a greasy road. They should not be attempted with a car of high centre of gravity owing to the possibility of overturning the car if portions of the road are sufficiently greasy. The Lanchester car, however, cannot be overturned by violent steering, as the centre of

gravity is so low that it can be made to side-slip safely even on a dry road.

The principal recommendation to users of cars practising grease evolutions such as figured in Figs. 46, 47, and 48, is that to learn how to side-slip is the most effective way of learning how not to do so, and a driver who has mastered the subject will drive with more confidence.

We do not take the responsibility of recommending drivers to practise these "grease" evolutions." We give what information we can for the use of any who wish to attain the highest degree of proficiency.



Fording.

A novice is often in some doubt in meeting with a "ford" on the road as to whether he can negotiate it or not. It is an unpleasant experience to find yourself in the middle of a ford with your engine "drowned out." especially where no assistance is at hand, or during the night.

A Lanchester Car may be easily driven through a ford or flood water which is not more than "hub deep." If, however, the water is more than a foot deep, it is often better to rush the position at full speed. In crossing water not exceeding a foot or 18-in.

deep, a car may be driven through on the low gear without the occupants getting wet.

It is unwise to attempt the crossing of a ford over 2-ft. or 2-ft. 6-in. deep, and where the depth is as much as 18-in. the best plan is to rush it at 20 or 25 miles an hour, at the expense of a considerable wetting.

In rushing a ford in this way, we have known the front road wheels lifted almost clear of the ground by the impact of water without any further consequences than the temporary silencing of the bell and horn, the motor not being affected in the slightest degree.

In cars employing "high tension" ignition, the ignition troubles are one of the principal causes of drivers "fighting shy" of water, but in the Lanchester Car, not only is the magneto ignition much less sensitive to water, but the ignition organs are quite protected, and a stoppage in deep water, if it occurs, is rarely, if ever, due to this cause.

How we Train Drivers.

A Squad of Drivers in Training.

In training drivers at our Works, it is customary to give them charge of the steering alone until they have rendered themselves thoroughly "automatic," the instructor taking charge of the brake and gears. When the driver shows himself quite master of his steering, so that it no longer requires his attention, he is allowed to take charge of the motor speed regulation. When he is clearly able to regulate his engine speed and steer simultaneously, and it is evident that these actions have also become practically automatic, he is then allowed to take complete charge. This may be regarded as an absolutely safe way of teaching driving, and if an instructor takes reasonable care, three or four lessons will be sufficient to render a man fit to take charge.

It is not the inability to drive a motor car in particular that we find deficient in drivers in training; it is frequently inability or unsuitability to drive anything at all. All drivers at our Works have to pass an eyesight test before they are put into training at all, and a good many are rejected as being unsuitable when in training. Rejections other than for eyesight are almost entirely on account of such matters as general slovenliness or bad time-keeping, and the inference is that with good training a man of the most ordinary intelligence has it in him to make a fairly good driver.

A few notes as to some of the principal defects in driving which we find most difficult to eradicate, may be useful to the learner:—

One very frequent weakness is the habit of making too frequent and violent use of his brake. Instead of hanging back in the traffic until he sees from a little distance his opportunity to get through, he has a tendency to rush right up to an obstruction and then pull up with his brake full on. Also, when stopping, instead of judging his distance and withdrawing his clutch, coasting into position, he apparently takes a delight in exhibiting his lack of judgment by rushing up at top speed, and stopping with his wheels skidding.

Another favourite weakness is to use a higher gear than the circumstances warrant; that is to say, either by failing to drop on to the low gear sufficiently soon when climbing a hill, or in trying to get the high gear in too soon when surmounting same. The same applies to starting.

Another bad habit that we find is very common with young drivers in training is turning corners with the brake on. The correct way of taking a corner is to slow up before commencing to turn. If the corner is a sharp one, the instructions we give are that a driver should slow up as if he intends to stop at the corner, and then steer round dead slow, without applying the brake, unless the road is found to be obstructed, and accelerating only when the road is seen to be clear. As long as the roads are dry and clear there is no particular harm in swinging round any corner with the brake on, but, as a matter of experience, it is found that a man who does this habitually sooner or later meets an obstruction at the moment of turning, or finds a greasy patch on the road where he did not expect it; he has nothing in reserve to meet with such a contingency. Whatever the capabilities of the machine may be,

the gratuitous usage of the brake *while turning* a sharp corner is bad driving.

The most prevalent defect in otherwise competent driving is getting "blanketed" behind slow traffic. Instead of judging the position and commencing to slow up well away from the obstacle in the traffic, and when there is an opportunity driving through, drivers frequently adopt the less intelligent course of driving right on until they cannot get any further, becoming masked behind an omnibus or some other vehicle, and at intervals they steer out in order to get round the obstruction just in time to find that they are too late to take advantage of the opportunity that has occurred.

Attendants' Duties.

Lubrication.

AUTOMATIC LUBRICATOR.

Before starting a day's run, see that the lubricator is filled. The lubricator tank when full will last about 140 or 150 miles. It should never be allowed to run itself empty, and must be refilled whilst there is at least about half an inch of oil in the bottom of the tank.

The automatic distribution of oil may be classified under two headings—viz., "major" and "minor" lubrication. The "major" lubrication lubricates the following parts :—

The Cylinders,
The Main Bearings, and
The Countershaft.

The attendant should occasionally inspect the lubrication pipes and see that they are acting properly, and should also see that the oil flows freely through the main-bearing tubes. These, if choked, may be washed out with paraffin without removing them from the motor. After washing them in this manner, lubricating oil must be poured down the tubes before running the engine.

CYLINDERS.

The lubrication of the cylinders is conducted direct through the pillars which support the main lubricator tank.

MAIN BEARINGS, CRANKS, Etc.

Oil is taken to the main bearings by four oil tubes which drip into cups fixed within the sides of the crank chamber of the motor. This oil is in turn fed into the crank pins, which lubricates the connecting rod bearings.

COUNTER-SHAFT.

The countershaft lubrication is supplied from the main tank, one branch of which discharges into a small flushing cistern, which in turn syphons its contents into the main countershaft bearing. This flushing cistern must always be clean and its action free, and may easily be removed for cleaning should its discharge pipes become stopped. A removable plug with screw-driver slot is provided for this purpose in our 1903 motors.

WORM TRANSMISSION.

We supply a special grease for lubricating the worm gear, which is done up in tins of a convenient size and form for the tourist to carry on his car.

The worm gearing should be lubricated once a week, or oftener if required.

To lubricate the worm, remove the grease cover from the top of the worm gear box. About one-third of a tin of worm grease

should be used on each occasion when lubricating.

N.B.—On no account must the worm be allowed to run dry. In the absence of our worm grease, use "solidified" oil or any grease available (suet, lard, or butter).

BALANCE GEAR

The balance gear of our 1903 cars is arranged to be lubricated automatically by the grease from the worm box. See that the worm box has a liberal supply of grease, so that there is no danger of it failing to find its way into the balance gear box. In our earlier cars the balance gear was enclosed apart from the worm box, and it should be lubricated once a week with ordinary cylinder oil, as follows:

An oil tube is provided between two of the teeth in the worm wheel. Before oiling see that there is a free passage through this tube by passing a wire down same. Then take the loco oiler and pour about half its contents down the tube.

N.B.—Do not leave the cleaning wire in the oil tube.

COUPLING SHAFT.

The coupling shaft requires lubrication at the joints at each end once a week. The lower joint, which runs within the "driving pot,"

is lubricated with grease, injected at the rear end of the worm centre stud, by means of the screw-down grease syringe supplied with outfit. Having first removed the grease cap, the grease syringe may be screwed into the end of the worm centre stud and the grease injected.

The upper joint of the coupling shaft, *i.e.*, the Hook's joint at the motor end, is lubricated with the same grease syringe as is used for the lower joint. A hole is provided in the floor of the tonneau to give convenient access. It is necessary to move the car along until the screwed hole in the side of the coupling block is visible through the hole in the tonneau floor. The grease syringe is then applied and the grease injected. In some of our earlier cars this grease injection is not provided for, and in this case it will be found that the caps on the ends of the coupling joint pins are hexagon caps, and it is necessary to unscrew these (four in number), fill them with grease, and screw them up again.

N.B.—Where cars are not fitted with grease distribution arrangement, it is as well to inspect these caps from time to time and see that they are properly in their places,

and care must be taken to screw them up tightly. In cars fitted with grease distribution arrangement, these precautions are not necessary.

It is as well to make quite sure that the syringe is working properly on every occasion when it is used, and when empty to wind the piston back, and see that at most only a very small portion of grease has leaked past.

Cases have come to our notice in which the grease syringe is apparently working all right, but the whole of the grease is found to have transferred itself from one side of the piston to the other, instead of being properly injected, owing to the wearing out or "inversion" of the cup leather.

AXLE BEARINGS. The axle (roller) bearings should be lubricated frequently, and when on tour every day. Lubricator fittings are provided, and a good dose of oil should be administered. Ordinary cylinder oil or any good lubricating oil is suitable. Every few weeks it is as well to run some paraffin through these bearings, especially in wet and dirty weather, the opposite side of the frame being jacked up so that

the paraffin runs round the axle neck. Where convenient, it is as well to jack up both sides, so that the wheel can be rotated as the paraffin is poured in.

N.B.—After cleaning with paraffin, lubricate thoroughly with cylinder oil.

The axle bearings of some of our cars are fitted with automatic lubricators. About a quarter of a pint of oil should be poured in on both sides, through the lubricator screw caps, every few weeks. Attendants can immediately see whether or not there is an automatic lubricator. Cars fitted with an automatic lubricator have a screw cap to admit the lubricating oil, instead of a snap-lid lubricator fitting. Also, the oil well is quite evident.

FRONT FRAME. The ball bearings of the front wheels should occasionally be washed out with paraffin, the screw plug being removed from the centre of the hub for this purpose, and paraffin being poured in, the wheel being rotated. Care should be taken not to get the paraffin on the tyres, or, should they become soiled with it, it should be wiped off immediately.

The ball head can also be cleaned by removing the screw cap in centre of ball head casting and pouring in paraffin.

N. B.—After cleaning with paraffin, lubricate thoroughly with lubricating oil.

SUSPENSION. The suspension requires lubricating at the following points: Both ends of upper links—front and rear; both ends of lower links—front and rear; the centre joints of springs, and the "leaves" of the springs themselves. The link ends are oiled with a hand oiler as occasion requires. The lower links are frequently found to get sufficient oil from drainage without special oiling. The ball joint and the upper link being liable to come into contact with the dress of the passengers, should be well wiped after oiling.

The centre joints of the springs also want lubricating. Oil holes will be found in the bolts in the floor of the tonneau and front floor board, one over each spring. A few drops of oil occasionally is all that is required. The springs themselves require greasing occasionally—especially in a new car, just as in the case of ordinary vehicles. Instructions as to this are given on page 182,

and it can be done most conveniently by jacking up the car, so that the grease may be thoroughly inserted between the leaves of the spring. A spring which is insufficiently greased will be easily recognised by the intermittent squeaking which occurs, especially over rough and lumpy roads.

STEERING. The steering mechanism should be occasionally oiled—a few drops of oil in each of the bearings of the tiller shaft under the leather flap of the front seat. Also in oil-hole behind steering-shaft coupling in the top of the lug on the side of under-body.

The link heads of the steering gear require very little lubrication, as they are designed to contain sufficient grease for a long period. Ordinarily it is sufficient to dismount the steering link once every few months, and refill the grease space with worm grease or solidified oil

RELIEF AND STARTING GEAR. A few drops of oil may also be occasionally required on the relief shaft neck and starting shaft bearing. The hole in the starting shaft should also be lubricated from time to time, as, should they become dry, the handle may "seize" when starting the

machine. A hint may here be given in case of a handle "seizure." The attendant should immediately stand back out of the way and lower the relief lever with his foot.

CLUTCH. If the clutch "squeak" at all when getting on to the high gear, insert a few pellets of our "clutch dressing" into the holes in front of clutch cone, under the countershaft aluminium gear guard.

SQUEAKS. Failure of lubrication in any part of a motor and car is usually announced by a squeak, which may or may not be a matter of serious consequence. The attendant should always endeavour to locate the squeak at the earliest possible moment, and the first point to note is whether the squeak appears to keep rhythm with the engine or with any portion of the gear, or whether it be an intermittent squeak without any particular period of frequency. One point is worthy of remark—that an igniter will occasionally develop a leakage round the igniter wire or the joint, which will give a squeak very similar to a squeak due to want of lubrication. Should this be suspected, the sparking plugs may be changed or new copper washer fitted.

GENERAL. The attendant should keep his car thoroughly clean—not only where it shows, but also underneath and internally, and he should remember that all necessary duties and attention should be given as soon as possible after the car has been in use, and not left to be done at the last moment, or while the car is on the road.

Instructions for the care and cleaning of body-work will be found under the heading "Housing and Cleaning." Separate cloths, rubbers, etc., should be kept for cleaning mechanism and greasy parts. We have brought out a line of oils and greases specially suited to the requirements of our motor cars, and we recommend that these should be used. In all cases where owners wish to employ other greases or oil, we shall be glad to express an opinion as to the suitability, if furnished with samples, but we do not believe that for either price or quality our products can be approached elsewhere.

Igniters.

There is no portion of an oil motor which repays better for care and attention than the ignition organs. In our motor

the only portion of the ignition mechanism which is liable to require attention is the igniter or sparking plug. A full description of the igniter and component parts is given on page 36 of the "Descriptive Manual."

In order that an igniter should be kept working at its best, it requires to be cleaned from time to time and the spark gap adjusted.

CLEANING AND ADJUSTMENT. On examining an igniter that has been at work for some time (two or three days' hard running), it will be sometimes found that there is a small amount of soot or carbonised oil on the mica insulations. When this is the case, the surface of the mica should be wiped, or, if in bad condition, scraped till a new surface is exposed. If the micas are found to be sooty on the inside, it is evident that the motor has been running with too strong mixture, and the driver's attention should be called to it.

The contact point between the wire and anvil should be kept in good condition, a file being passed between the two points, should they become pitted or show much corrosion. Small files are provided in the tool outfit for this purpose. If an igniter

wire is too much worn, it should be replaced with a new one.

The wire should be free in the bush, between the collars, but no very perceptible longitudinal backlash should be allowed; if it is noticed, open the ends of the wire more fully.

If, when adjusting a sparking plug, the wire is found to be worn away, as in Fig. 63, it should be replaced. (See "Replacements.")

The spark gap should be adjusted to within about the thickness of two or three igniter springs. Igniter springs should be replaced when they have done 400 or 500 miles running, and the old one discarded as worn out.

A few drops of cylinder oil may be put on the locking handle screw thread, but *not on the working parts of the sparking plug.*

REPLACING IGNITER SPRINGS. The life of an ignition spring is about 1,000 miles. After running this distance it is sufficiently worn on the point to require replacement. To remove old spring, force over to compress tail spring till hole is free from detent (Fig. 61), and then pull

Fig. 61.

out from between cover plates (Fig. 62). The new spring should be inserted in a similar manner, by slipping it edgeways into detent, about its widest part, then passing it point foremost between the cover plates

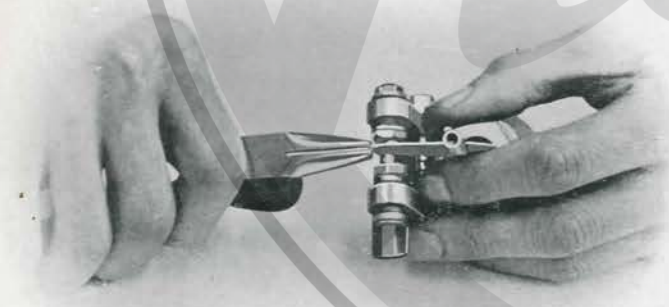


Fig. 62

until the detent snaps home. Only occasionally springs break when running. In this case it is quicker to replace igniter with spare one provided. It is a good plan when on tour to change ignition springs every 400 or 500 miles; the cost (2d. each) is too trifling to be worth consideration.

Sparking Wire, complete, with Collars and Cover Plates. Fig. 63.

REPLACING SPARKING WIRES.

A sparking wire has a life of from 1,500 to 3,000 miles. It requires replacement when the contact end is worn sufficiently away, as shown in Fig. 63.

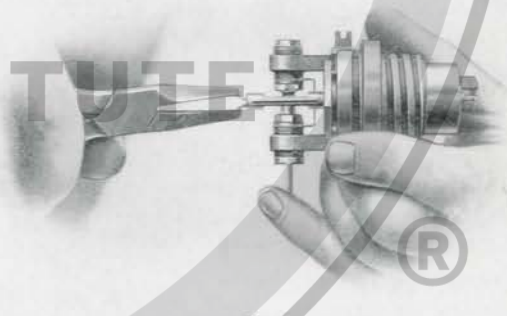


Fig. 64.

To remove old wire, close end together with pliers (Fig. 64); then remove outer

collar and swing igniter spring out of the way (Fig. 65); then pull off the second collar with cover plates and withdraw wire (Fig. 65). Put in new wire, replace collar with cover plates and spring, and open out ends of split wire, as shown in Fig. 64.

Fig. 65.

When fitting a new wire, it is as well, before adjusting the spark gap, to pass the file two or three times between the contacts.

REPLACING INSULATION. After long-continued usage the micas may require replacement. No special instructions are required. Sufficient mica washers are provided, and must be packed to the thickness required (Fig. 66).

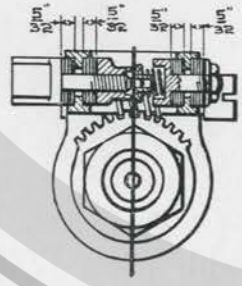


Fig. 66.

GENERAL. All renewals, adjustments, and cleaning of igniters should be done at leisure, and the spare igniters should be kept in good condition, and should be tested in place after adjustment, so that should a change be made on the road, there is no doubt as to all being right.

Should an igniter spark outside on the road to any appreciable extent, it may be set up without stopping the engine. To do this, the locking handle should be slacked off slightly and the adjustment screw turned counter-clockwise until the sparking ceases. The locking handle is then tightened up again.

We recommend in general that an igniter which sparks outside should be removed and receive attention; but the above method of dealing with an igniter whose contact is worn will save time on the road.

N.B.—The sparking contact must not be set too close. *The points must not make permanent contact.*

When and What to Adjust.

It is quite as important for the user of a car to know when any portion of his car requires adjustment as for him to understand how such adjustment is to be made.

The principal points which require adjustment are as follows, and each of the items mentioned has its own special means of adjustment provided.

The adjustments required for the brake, clutch, and change gear are provided in order to take up the wear of the frictional parts.

The indication of these adjustments being required is that the speed levers have too much free play before the brake or gear, as the case may be, comes into operation.

BRAKE AND CLUTCH.

The motion permitted to the high gear lever is indicated and is rendered self-evident by the notches provided for the finger pawl. The brake and clutch may be adjusted when the brake on the one hand, or the clutch on the other, does not come into operation until about two-thirds of the total range. The adjustment provided in both these cases is by the insertion on the one hand, or withdrawal on the other, of the

special washers which give a definite amount of adjustment, and it is necessary to wait until sufficient wear has taken place to admit of the adjustment being made.

Fig. 49 shows a brake adjustment washer which is made in two standard thicknesses, the thinner one being pierced with an oval hole to avoid mistake. Fig. 50 shows one

Fig. 49.

of these washers being inserted. It will be understood that two of these washers are required to make an adjustment, being inserted symmetrically one on each side of the brake ring. Care must be taken that the washers used are of the same thickness. Before inserting these washers the pin by which the brake ring is secured to the brackets must be slacked out sufficiently to allow of the washers being put into place,

having previously removed the split cotters and detached the locking plates. The split cotters and locking plates must be replaced when the adjustment has been made. A pair of these washers will set a brake up five

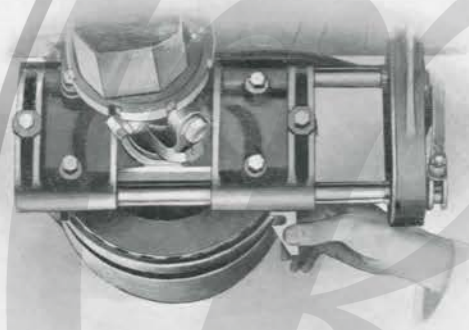
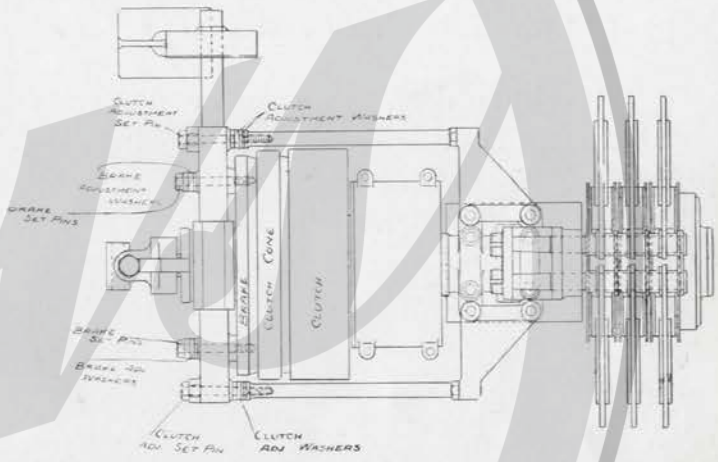


Fig. 20

or six notches of the hand lever. The thicker washer will set it up about nine notches. Before the brake-adjustment pins are tightened after the washers have been inserted, the brake should be notched on as hard as it will go. This ensures that the brake ring is tightened up accurately true to the groove in which it works.

The clutch adjustment is shown by the "Underview of Countershaft," Fig. 21 of the Descriptive Manual, reproduced here. In

order to set up the clutch, first remove locking-plate and slack out the pins found in the tonneau floor. These are the pins by which the actuating portion of the clutch is secured, and these must be slacked off sufficiently before, and tightened up after, the adjustment has been made. In order to make



UNDERVIEW OF COUNTERSHAFT.
Fig. 21.

the adjustment, the pins entitled "Clutch-adjustment Set Pins" are removed sufficiently, and one of the clutch-adjustment washers is *taken out* of each side. The pins are then replaced and screwed home. The split-pin and locking-plate must be removed from the head of this set pin before it can be taken out, and must be replaced

afterwards. Do not forget to tighten up the set pins in the tonneau floor and replace locking-plates after this adjustment has been made.

Removal of a pair of clutch adjustment washers provided makes a difference of about seven notches in the position of the hand lever pawl at which the clutch comes into action.

If either the high gear or the brake adjustment is made sooner than required, the result is that either one or the other will engage when the lever is in its central notch, and although, so long as the clutch and brake do not definitely overlap, the car may still be driven, such over-adjustment is very inconvenient.

CHANGE GEARS AND REVERSE.

The change gears and reverse gear are fitted with screw adjustment, and as frequently as the driver wishes they can be adjusted up to whatever degree of closeness is desired. There is no necessity to wait until any definite amount of wear has taken place. These gears should be set up so that they come securely into operation when the lever is about half-way from the middle notch, either forward or backward respectively.

Fig. 51 shows three screws by which the change gear and reverse adjustments are made. The function of the screws is indicated on the figure. In all three cases turning the screw clockwise sets the gear up, and turning it counter-clockwise sets it back. The

Fig. 51.

action is positive in both directions, and, as will be seen from the figure, consists in a worm gear acting on a right and left hand screw coupling. In making these adjustments a long screw-driver must be used, and must

be passed down carefully between the cam shaft and side plate of the motor. Do not attempt to adjust the gears in a bad light, and be careful not to foul the armature or other electrical connections. For the more convenient identification of these parts, reference may be made to Fig. 20, Descriptive Manual, reproduced here.

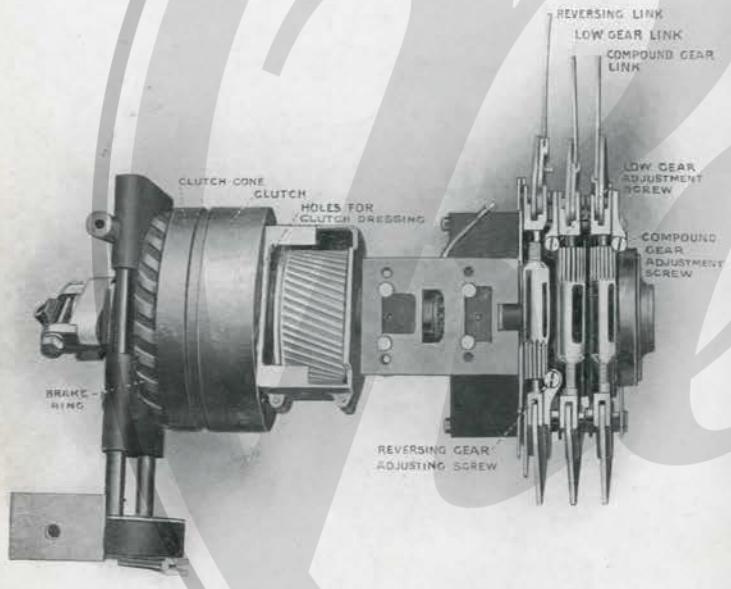


Fig. 20.

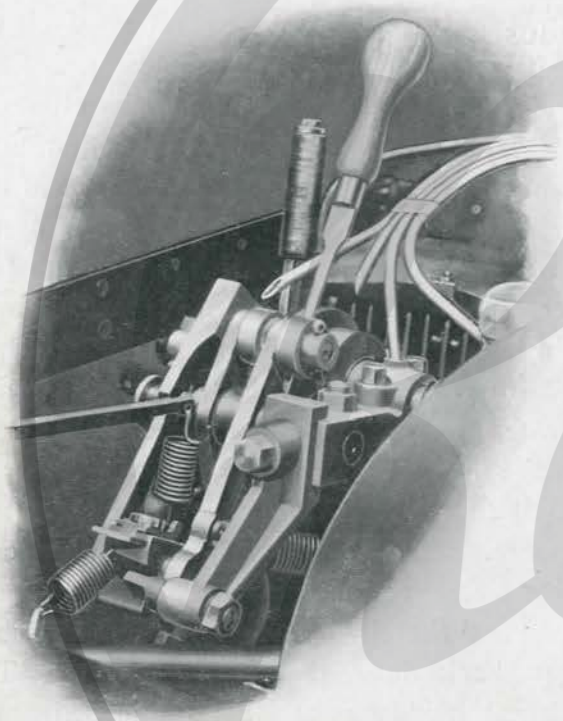
If, after adjusting the gears, it is found that a car goes sluggishly, and on taking out the clutch and stopping the car on the level the car continues to move either forwards or backwards, it is evident that an over-adjustment

has been made, and the gear should be "set back" a little.

FEED VALVE ADJUST-MENT.

The feed valve used in the valve gear of the Lanchester engine serves to control alternatively the discharge of exhaust gases and the admission of carburetted air. In carrying out this double function, it is arranged to seat alternatively on to one of two apertures. Its motion enclosing one of the apertures is positive, actuating from the feed lever, and it is returned to the other side by a spring. It is the positive seating which is liable to require adjustment, the valve being operated by a steel plate, which should be just the necessary length to seat the valve and hold it to its seat with a certain amount of pressure. After a time sufficient wear may take place to prevent the valve coming properly home, and thereby allow a leakage of exhaust gases back into the new charge. The principal evidence of this noticed by the driver is a certain amount of sluggishness in running, combined with a strong exhaust smell, and, if very bad, considerable overheating. To test for this adjustment, the engine fly-wheel should be turned round by hand until the feed cam roller is on the top of its rise (see Fig. 52). A small screw-

driver can then be inserted between the cam and the lever head, and if any backlash exists, due to the valve not being properly seated, it



TESTING FOR FEED VALVE ADJUSTMENT.
Fig. 52.

is at once evident by the movement that can be imparted to the feed lever by prising the roller head of the feed lever off the cam. If motion is found to exist, an adjustment should be made.

Fig. 53 shows the feed lever with the governor tumbler and governor blade in place. It is the governor blade which engages and presses home to its seat the valve by which the new charge is admitted. The adjustment by which this governor blade is

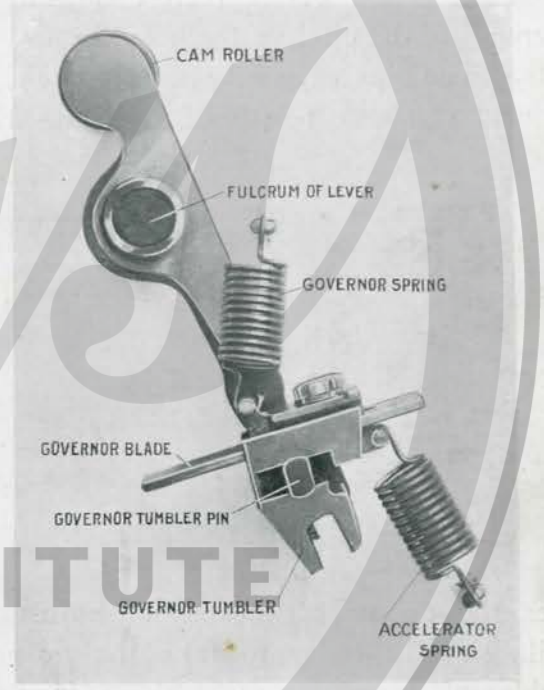


Fig. 53.

lengthened or shortened is shown by Fig. 54, which shows the various component parts. On referring to this figure, it will be noticed that the governor tumbler and governor blade

are furnished each with a series of holes. These are arranged on the principle of the "vernier." A peg, termed the "Adjustment Pin," is inserted in any one of the holes. In changing this pin from one hole to the next, the governor blade requires to be moved a small fraction of an inch owing to the difference of the pitch of the holes in the two parts. The difference between one hole and the next is about 1-64th of an inch, which

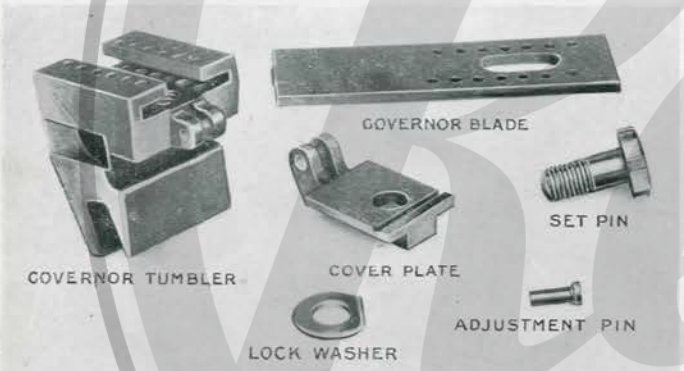


Fig. 54.

gives the degree of fineness of adjustment available. In order to take the governor tumbler off its pin to make this adjustment, the strap tying the end of the lever pin to the valve-box is removed after slacking back the nut at its valve-box end. The governor swing-bar is then taken straight off, and, after detachment of the governor and accele-

rated springs, the governor tumbler is turned round till the blade is nearly vertical, when it can be withdrawn This method of detachment is evident by reference to Fig. 53.

GOVERNOR SPEED ADJUSTMENT.

After a car has been running some time, it is frequently found that one of the cylinders becomes a lot "faster" than the other, or when both governor levers are in their lowest position the running speed of the engine may be too high. This can be adjusted by slightly bending the governor actuating lever—that is to say, the long wrought-iron arm which carries at its end the upper extremity of the governor spring

Fig. 42.

(see Fig. 42). It is sufficient to bend this so that when the governor operating levers are in their forward position, or "right down," the speed of the engine is about 400 revolutions per minute (200 revolutions of the cam

shaft), so that it will run nice and quietly when standing. It is not necessary for the governors to give the same speed in all positions; the driver can adjust this as he likes when running. If it is anticipated that a feed-valve adjustment is required, this should be done first, as the feed-valve adjustment affects the governor speed.

SUSPENSION. Provision is made for adjusting the ball joints of the suspension when they develop excessive backlash. This requires doing when the suspension becomes too noisy. The motions of the balls in their places will be quite visible to anyone sitting on the car, and give an indication of the extent to which adjustment is required.

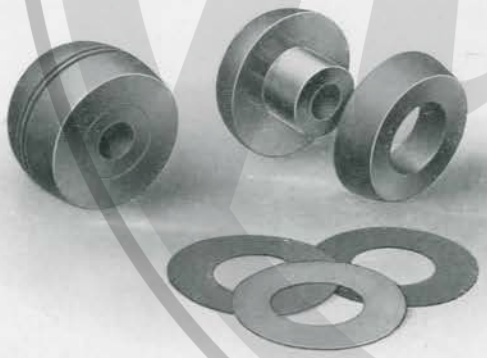


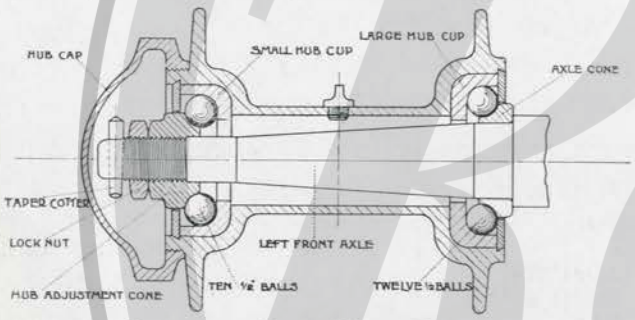
Fig. 55.

Fig. 55 illustrates the manner in which the suspension ball joints are adjusted. The

balls themselves are made in two halves, one half of which threads on to the other; and when adjustment is required, metal washers, as shown in the figure, are inserted between the two half balls, and the ball replaced in position. It is sometimes found necessary, in order to make a good job of this adjustment, to carefully ease out the ball socket with a scraper, owing to the wear having taken place unequally. This is a job that can be done by any decent fitter, but is not absolutely necessary. The balls must not be over-packed; they must work quite freely in their sockets, and must not jam in any position.

ADJUSTMENT OF FAN TENSION. The drums of the cooling fans are held in contact with the fly-wheel rim by springs, which can be adjusted if required. If, owing to the engine heating or from other cause, it is suspected that one of the fans is not working properly, it should be inspected from the tonneau, after the removal of the drop screen. The fan tension should be sufficient to prevent the fan spinning round after moving by hand, but not sufficient to prevent the possibility of moving it by hand when taking hold of the friction drum. It should, however, take considerable effort to move

the fan round with one hand by the friction drum, and it is better to err on the side of having rather too much tension than too little. The adjustment on our standard 10-h.p. car is by means of a plate with a series of holes, into which the hook of the fan spring is threaded. To get at the fan springs properly to make this adjustment the body-work should be stripped. (See pages 15-17 Descriptive Manual.)



SECTION OF FRONT WHEEL BEARING.
Fig. 55a.

FRONT WHEEL BEARING.

The front wheel bearing requires adjustment occasionally. This, in our standard 10-h.p. car, is a ball bearing of the ordinary cycle pattern. The car must not be driven with any appreciable backlash in these bearings, as any slackness will lead to the cones and balls being broken, and will eventually result in the axles and hubs being dangerously grooved by the fragments and sound balls

getting in between the axle and the barrel of the hub. The condition of these bearings should be tested by jacking up and feeling for side play when cleaning the car. Any want of adjustment that may manifest itself should receive prompt attention. They should be thoroughly cleaned out and examined every 1,000 miles, the bearings filled with worm grease and adjusted. The adjustment cones should be screwed up until there is no backlash in the bearing, but not sufficiently tight to prevent the wheel swinging with the weight of its valve. If any of the balls break or fail, all the balls in the race must be replaced. The addition of one or two new balls amongst others that have worn even slightly, is prejudicial to the durability of the bearing parts.

N.B.—The hub adjustment cones and lock nuts (see Fig 55A), are screwed left hand for the right hand wheel, and right hand for the left hand wheel.

IGNITION TIMING.

The timing of the ignition has no definite means of adjustment provided, but it is affected by the wear of the igniter spring. After the spring has been in use some time the ignition gets earlier, owing to the wear on the end of the spring causing it to release earlier than

when new. Fig. 56 shows the method by which the time of the ignition may be checked. The correct time of sparking for each cylinder

Fig. 56.

is marked on the fly-wheel, and the moment of ignition is when the mark passes the centre of the armature operating lever set-pin on the right-hand side of the motor. In Fig. 56 the right cylinder ignition is shown as just taking place, with the mark on the fly-wheel rim in the correct position. This mark may be regarded as the earliest permissible, and when an igniter spring has so worn that the time of ignition takes place before the mark is reached, the spring should be changed. In making this test the fly-wheel must be pulled round by hand, *with the engine on full compression.* The starting mechanism, by which the starting handle is put into gear with the fly-wheel, entirely alters the ignition timing as well as lessening the compression.

N.B.—We have had customers make this mistake, and wonder why their car is running so well with the ignition *six inches out of place.*

In Fig. 56 an indication is also given of the latest permissible. The ignition should be in or about this point when a new igniter spring is fitted. The total variation in the time of the ignition should be about one inch on the fly-wheel rim.

No means are arranged for adjusting the igniter which comes outside this variation. Reference on this point may be made to our Engineers' Manual; but if the ignition is seriously out, customers are requested to communicate with the company or a qualified firm of repairers.

LEATHER SLEEVE.

If the leather sleeve on the coupling shaft is found to be worn out or leaky, a new one should be fitted. It should be attached to the driving pot on the worm shaft of the rear frame by means of copper wire binding tightly whipped round the neck portion. Some cars are fitted with screw union, to which the leather sleeve is riveted. The front end of the driving sleeve must be tied

up in such a way that grease will not escape. An approved method of tying this bag is illustrated in Figs. 57, 58, 59, and 60, in which Figs. 57 and 58 show how the lace

Fig. 57.

is threaded, and 59 the complete tying. Fig. 60 shows more clearly the exact arrangement when the job is complete. The material used should be a leather or catgut lace. A good strong boot lace may be used in the absence of a round cat-gut lace, such as we supply.

N.B.—The cat-gut lace should be thoroughly soaked in warm water before being used. This greatly increases its durability.

The adjustment of the igniters has been dealt with under a special heading (page 137),

but it may be stated here in brief that the evidences of adjustment being required are,

Fig. 58.

principally, missed ignitions, with or without "sparking outside." The adjustments should

Fig. 59

Fig. 60.

be made to igniters before they show any symptoms of requiring attention, as explained.

Tyres.

INFLATION. One important point which the automobilist has to look after is the proper inflation of the tyres. If the tyre is inflated too much, the vibration of the car is much greater, and in addition the compressed air is putting too much pressure on the walls of the tyre. Although the tyres we fit can stand a very high pressure, it is more advantageous not to put too much strain on them. On the other hand, there must be enough air in the tubes, as otherwise the weight of the car presses the tyres flat, and causes them to be cut by the rim.

We recommend the tyres of the Lanchester Cars to be inflated as follows :

45-lbs. per sq. inch for the front wheels.
65-lbs. ,, ,, ,, for the rear or driving wheels.

In the country, and where there are rough and stony roads, it is advisable to inflate the tyres a little more than the usual pressure. In warm weather, the tyres should not be inflated quite so much. One can easily see from the way in which a tyre rests on the ground whether it is sufficiently inflated or not. An insufficiently-inflated tyre naturally

wears out more quickly than one which is properly inflated. It is, therefore, advisable to have a look at the tyres every day and inflate them again if necessary.

If the car is in constant use, it is best to keep the tyres fully inflated always. If, however, the car is not used for months at a time, the air should be let out of the tyres, after a prop has been put under the axles so as to relieve the tyres from the weight of the car. If this is not done, the covers, as well as the tubes, will become defective in time in the places where the weight rested.

ATTACHMENT. *Safety Bolts.*—Thoroughly clean the inside and edges of the rim of all rust, sand, small stones, etc. After having done this, put the safety bolts in the holes which are drilled for them in the rim, and screw the nuts in loosely.

Air Tube.—Now take the air tube, inflate it slightly, and place it in the cover so that the valve is opposite the notches cut in the thickened edges of the cover. The reason we recommend the tube to be slightly inflated is that it can be put into the cover more easily in this condition, and it also prevents creases in

the tube. Then proceed, putting the cover and tube over the rim. Take off the top part of the valve so as to allow same to pass through the valve hole.

Inner Edge of Cover.—Now begin putting the edge of the cover beside the valve into position, using a tyre lever for this purpose. Having put one side of the cover into position, the safety bolts, of course, lie under the thickened edge. To get same into the right position again, take the lever and with the aid of same slightly raise the edge of the cover near the stud, so as to relieve same. Then press the safety bolt inwards (as Fig. 1 shows) and draw it back again. Now the cover and bolt are in the right position (see Fig. 2).

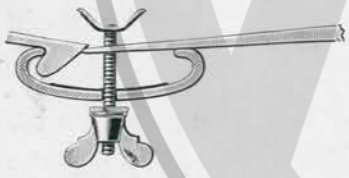


Fig. 1.

Fig. 2.

Outer Edge of Cover.—After having attached one side of the cover in the manner above described, take the other side, again using the lever. Care, however, must be taken not to damage the tube. Take

great care not to pinch the tube between cover and rim.

With regard to the safety bolts, these must again be pressed towards the inside of the tyre, so as to allow the edge to get into its proper position. Then draw the bolts back again. See that safety bolts are free.

Precautions Previous to Final Inflation.—After both edges of the tyre have been fastened in the rim, the real attachment of same has been completed, and the only thing left to be done is to screw the nuts up tight. Before doing so, however, it is advisable to make sure that the tube has not been nipped. To test this, push the bolts inwards and draw them back again. If this can be easily done, the tube is in the right position. If, on the contrary, some-

Fig. 3.

Fig. 4.

thing resists the bolt, either the tube has been nipped (see Fig. 3), or the cover has been wrongly mounted (see Fig. 4), and in

this case the edge of the cover has to be lifted up slightly to allow of the safety bolt finding its bearing.

These precautions are necessary, and should not under any circumstances be neglected.

Then tighten nuts of valve and safety bolts by hand. Do not use a spanner of any sort.

Inflate the tube now to its full extent and again tighten the nuts on the valve and bolts The attachment is now finished and the tyre ready for use.

DETACHMENT.

Preliminaries.—Deflate air tube and loosen nuts of the safety bolts. Remove the dust cap and washers from the valve and let the air escape from the tube. Having done this, unscrew the nuts of the bolts right to the end.

Outer Edge of Cover.—Place the lever between the rim and the edge of the tyre, and lift the cover out of the rim (see Fig. 5). To loosen the edge where the cover is held in position by the bolts, push the same towards the inside of the tyre.

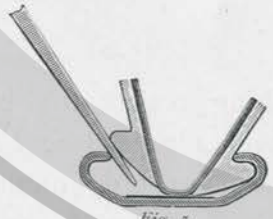


Fig. 5.

In this way one edge of the tyre is detached.

Extraction of Tube.—If the tube has become defective through any cause and it is necessary to replace same, it is best done in the following manner:—

Follow the instructions given in the previous paragraphs as to removing one of the edges from the rim while the other remains in position. Having done so, take the tube out of the cover, starting at the opposite side from the valve (half the length of the tube away from the valve). On coming to the valve, press the cover with one hand on one side, and with the other hand pull the valve out of the hole.

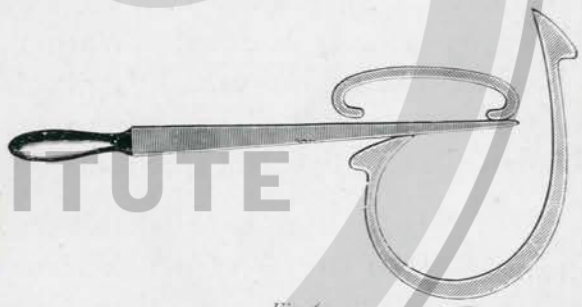


Fig. 6.

Inner Edge of Cover.—Push the lever between the cover and rim and lift the cover up. Press the bolt towards the inside, and draw it back so that the

flange of the bolt is now lying in the base of the rim. Having done this with all the bolts, push the lever between the rim and the edge of the cover, as shown in Fig. 6, and ease cover off rim.

INSERTION OF NEW TUBE. After extraction of tube (*ante*), the new tube is tucked into the cover deflated. Take off the valve cap and washers, and put the valve through the valve-hole. The cover has to be pushed a little on one side so as to allow the valve to pass into the hole. Now put the tube into the cover all the way round and inflate slightly. Then try the studs by pushing them up and down so as to make sure that the tube is in its right position and not nipped. Then proceed with the fixing of the edge as already described. When this has been done, secure the valve by tightening down the valve screws and nuts of the studs, and inflate the tube to extent specified.

TUBE REPAIRS. If the tyre is found to leak to such an extent that it requires pumping oftener than once a day, it should receive immediate attention.

A tyre that requires pumping more than once a week should receive attention as soon as convenient.

In either case, the proper proceeding is to remove one edge of the outer cover and replace the defective air tube with a spare one which has been carefully tested.

Examination.—In the majority of cases, a leakage of an air tube takes place round the valve. In all cases, however, an air tube which is defective should be examined throughout, as it sometimes happens that there is more than one defect.

Take a bucket or basin full of water. Partially inflate the air tube and immerse the portion surrounding the valve, slightly stretching at the same time, when, should a defect exist in the portion immersed, bubbles will arise. Then proceed to immerse the whole tube, piece by piece, in a similar manner. If no defect is found, it may be assumed that the defect is in the valve or valve attachment, which only leaks under high pressure.

Simple Puncture.—Thoroughly clean the surface round the defective place with a piece of glass-paper, and wash well with mineral naphtha (otherwise known as benzene or benzol), but on no account use benzoline or motor spirit. The same process to be gone through with the repair patches.

Then solution thoroughly the defective part of the tube, as well as the rough side of the patch, and let them dry for at least ten minutes or a quarter of an hour. Then take a small piece of the thin black rubber provided (supplied with repair outfit), which has been solutioned lightly on both sides. Place this over the defective part and put the repair patch on top. The piece of semi-vulcanised rubber employed should be about half the diameter of the patch. Having thoroughly pressed the patch down, place some heavy article on the top and leave for a few hours. It is better not to use till the next day an air tube which has been repaired.

Should a puncture be in the immediate neighbourhood of an existing patch, the old patch should be stripped right off, and a large patch, covering both punctures, substituted. When an old patch has been stripped off, considerable care should be taken to thoroughly clean the surface. This is often a long job, requiring considerable patience.

Valve Troubles.—When possible it is as well to test a valve before removing a tyre, to make certain whether or not the valve itself

leaks, as a higher pressure can be employed before the tyre has been disturbed. It will be invariably found that if a car has been run even a few hundred yards on the rim after the tyre has become deflated, the valve joint will be disturbed and require remaking.

An inner tube should never be passed as sound after repairing a puncture that has not had the valve joint carefully examined.

Refitting Valves.—If a valve requires to be refitted to an inner tube, it is always better to fit it in a new place.

First, slightly inflate the inner tube and mark a new position for the valve so that it shall lie naturally central. The valve patch should be removed and the valve withdrawn, the hole being treated as a puncture and repaired with a strong patch in the ordinary way.

Strip the valve fittings of all caps, nuts, etc.

Cut a hole in the inner tube at the place marked, about the size of an ordinary lead pencil. Stretch the inner tube over the head of the valve tube and solution thoroughly, but leave space round the valve

of about the size of a half-crown without solution and thread on round-edged washer. Then prepare large valve patch provided in a similar way, leaving area round central hole not solutioned. Allow to dry as in the case of ordinary repair, and thread patch on over valve tube and knead well into position. Press thoroughly all round edges and put under weights to dry. Do not use tube for at least twenty-four hours after repair.

N.B.—These instructions as to refitting valves only apply *in toto* when using special valve patch supplied by us.

We supply one spare air tube with our car. We recommend owners who are touring far afield to provide themselves with a further spare one. Should it be necessary to repair a tyre without a spare air tube, there is always a risk of the patch becoming detached after going a very short distance. The effectiveness of such repairs depends almost entirely on the skill of the operator, and it is rarely that a permanent repair can be made on the road without a spare inner tube.

COVER REPAIRS.

Repairs to the covers of pneumatic tyres are of a somewhat varied nature. Some of the repairs which a cover requires are such as

can be tackled by an automobilist on the road or at home. In other cases, the repairs can only be effected at the rubber factory. The classes of defect liable to manifest themselves are as follows:—

Punctured Wounds.—A punctured wound penetrating the cover is sometimes caused by a sharp flint, broken bottle, etc., and results in sufficient injury to require immediate repair. A less extensive injury from a similar cause sometimes shows up only after considerable further driving. In this case, frequently the first notice the driver has is that the tyre bursts, either with the noise of escaping steam, or with a report like that of a sporting gun.

If the wound should be of sufficient dimensions to expose the air tube or to seriously weaken the cover locally, a patch of two or three thicknesses of solutioned canvas should be arranged inside, the interior of the cover being thoroughly scraped and solutioned in the ordinary way, and the canvas patch should extend from side to side, and one layer at least should lap right over the beads of the cover and be solutioned well to same. After putting on a patch as above described, it should be

allowed to dry thoroughly (one day will be usually sufficient) and thoroughly French-chalked before replacement.

Superficial Injuries.—Besides the above, there are purely superficial injuries to the tread of the tyre which occur more or less frequently at all times.

These should receive the attendant's attention and be plugged, if large enough, with solution and small pieces of unvulcanised rubber, or, if small, should be simply injected with solution, the object being to prevent the access of water in wet weather, and dust in fine weather, to the canvas structure of the tyre. If the superficial wounds are neglected, the canvas is liable to become sodden and rot, or quantities of dust will accumulate under the tread and gradually separate the tread of the tyre from the canvas structure.

Disintegration of Canvas—Old Age.—Another class of failure is that due to the disintegration of the canvas substance of the tyre by its own internal friction. This does not occur on any well-made tyre that is kept fairly well inflated, until the cover may be said to be practically worn out. Under this heading may be mentioned the local failure and disintegration of the canvas substance in

close proximity to the edge of the rim. This also is a defect which is more likely to manifest itself in a tyre which is insufficiently inflated, but which sometimes occurs without any definite explanation being forthcoming; but in a well-made tyre it may be classified as a "disease of old age."

A cover that suffers a general disintegration of its structure is not susceptible of repair. The symptoms of this are usually that the tyre explodes with a loud report, and it is found that there is a diagonal or jagged slot about two or three inches long, through which the air has blown out. On removing such a cover from the rim and pressing it into an oval shape, a number of half-developed splits can be seen in the canvas, which are so many lines of weakness, liable to rupture at very little provocation. Such a cover is quite useless, and cannot be repaired. If this occurs early in the life of a tyre, it is evidence of bad manufacture, and, in any case, it should not occur in a well-made tyre which has always been driven sufficiently inflated.

Splits at Edges.—When a cover develops weakness and splits at its edges only—that is, close to the bead where it bears on the edge of the rim, a repair can be made, *provided the*

cover is otherwise sound, that will last a considerable time by patching the inside and bead with two or three layers of canvas, and having it sewn through both edges of the weak place—that is to say, through the bead on the one hand, and through the edge of the cover on the other hand.

The best plan is to put the patch in position and mark where the stitching is required; any cobbler will then make a job of it. This difficulty usually manifests itself in tyres that have been running somewhat slack, especially in districts where the roads are narrow and very tortuous.

EFFECTS OF INFLATION. In brief, it may be said that pumping tyres too hard tends to cause superficial damage to the tread, and occasionally punctured wounds to the cover. On the other hand, pumping tyres insufficiently causes internal wear, and, so to speak, premature old age. Also injury to the inner tube, known as "chafing," is more liable to occur in tyres that are insufficiently pumped.

TRANSFERENCE FROM BACK TO FRONT. The tyres of our front and rear wheels are interchangeable, and we recommend customers to transfer tyres showing any weakness from the driving to the

steering wheels, in which position their duties are much less severe. A tyre which is useless for the driving wheel will sometimes last a very long time when given less work to do.

CARE AND PRESERVATION OF TYRES. In order to reduce as far as possible the tyre bill, it is a good plan to have a spare pair of tyres in addition to the set in use

When the treads of the tyres begin to show signs of cutting or wearing through, the spare pair of tyres should be put on, and the damaged ones carefully cleaned and any dirt removed from the cuts, especially where the canvas structure of the tyre has been exposed. These tyres should then be put in a warm, dry place for about a week, or longer if necessary, to expel all water and thoroughly dry the canvas structure. All holes and cuts should then be plugged with solution, or solution and pure rubber plugging, so as to render the cover entirely waterproof. The tyre should then be allowed to rest in a warm place for another week, and can then take its place in service. Tyres that are preserved in this way from rotting in their structure will well repay for re-vulcanising, and frequently last just as long after re-vulcanising as a new tyre.

RE-VULCANISING. Tyres which are sound in their structure, but of which the tread is worn through, can be sent to the rubber works and have a new tread vulcanised on; structural repairs also of injured, but otherwise sound, covers can be executed in a much more permanent and solid manner at the maker's works. In all cases we are prepared to receive and examine damaged tyres, and advise our customers as to whether or not they are worth sending for reconstruction or repair.

Housing and Cleaning of Carriage.

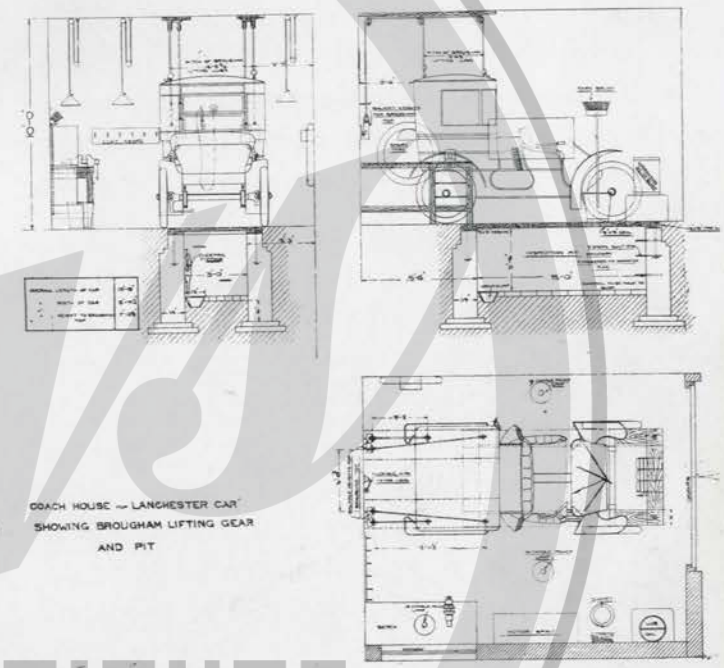
The following notes are intended for the guidance of, and involve duties that can be safely allotted to, an ordinary coachman who has not had any training as a mechanician :—

1. The carriage should be kept in an airy, dry coach-house.

2. When the carriage stands unused for several days, it should be covered with a dust sheet.

3. When a carriage is new, or newly varnished, it is better for it to stand a few days, and to be frequently washed and well dried off before being used; frequent washings with cold water and exposure to fresh air in the shade will tend to harden and brighten

the finish. Never allow mud to remain long enough upon a newly-varnished carriage to dry upon it, or spots and stains will invariably result.



COACH HOUSE — LANCHESTER CAR SHOWING BROUGHAM LIFTING GEAR AND PIT

PLAN FOR MODEL MOTOR CAR HOUSE, ARRANGED FOR LANCHESTER MOTOR BROUGHAM.
LANCHESTER ENGINE COMPANY, LTD.
N.B.—Large Scale Photo-Prints (¾-in. to 1-ft.) can be supplied on application.

4. When washing a carriage, use plenty of water, but take care that it is not driven into the upholstery to the injury of the lining. Use for the body panels a large, soft sponge; when saturated, squeeze this over the panels, and by the flowing down

of the water, the dirt will soften and harmlessly run off. Care should be taken to wipe the surface quite dry with chamois leather after washing. Care must also be taken not to hose into the machinery space or on to the horn or bell. The latter should both be tested when wiping down, and failure of either one or the other (usually due to the careless admission of water) should receive attention.

5. The directions just given for washing the body apply also to the under parts and wheels, but use for the latter a different sponge and chamois than those used on the body.

6. Never allow water to dry on the carriage itself, as stains will result. Hot water and soap should never be used in washing a varnished surface. For carriages painted in light colours, however, very weak soap and water may be used, and is sometimes necessary.

7. Enamelled leather heads and aprons should be washed with very weak soap and water. No oil should be put on enamelled leather.

8. After washing, before leathering, remove all traces of lubricating oil or grease.

9. Grease the springs occasionally to prevent them squeaking; this is best done by jacking body of car near spring and working paint or grease in with the blade of a knife, wedging leaves of spring apart with a screwdriver.

10. Swill bearings of axles and steering heads with paraffin, afterwards oiling with cylinder or other good lubricating oil.

11. On no account allow paraffin or lubricating oil to come in contact with tyres, and wipe all grease or oil off at once.

12. When carriage is dusty only, it should on no account be wiped with a cloth; a feather brush may be used with effect if time will not permit of its being washed. The feather brush for this purpose should be of the softest description, and must be used very lightly, to injure the varnish as little as possible.

13. Keep a small tin of quick-drying black japan and a brush always handy to paint the steps where worn; also the edges of the wheel rims. Lay on the japan as thinly as possible.

14. Clean and polish lamps and all plated work, using polishing paste (if necessary) and leathering, being careful where

plated work joins enamelled work not to injure the latter. The lamps should be cleaned and trimmed, care being made to ascertain that the proper sort of oil is used. For acetylene lamps see special instructions.

Mechanician's Programme.

The following programme is intended for the Mechanician, as a rough guide to him in his duties. It is, of course, impossible to specify exactly when these items will require attention, as, for instance, all the external joints that can be got at by the rain will require lubrication immediately after a wet run, quite irrespective of when they were lubricated last.

EVERY DAY.

1. See that there is oil in the main lubricator.

2. See that the main lubricator is feeding properly.

3. See that flusher is working freely.

4. Fill hand oiler on car.

5. See that bore of starting shaft is clean and slightly oiled.

6. Make sure that igniters and spares are in good condition.

7. Clean fan fly-wheel rim, either by simply scraping or wiping, or by using a small amount of common petroleum. A dirty fly-wheel rim will make the fans noisy.

EVERY 200 MILES.

1. Lubricate fans.

2. Lubricate front wheel hubs.

3. Lubricate rear axle neck bearings.

4. Lubricate steering coupling link pins.

5. Lubricate suspension pins, upper and lower, on front and rear frame.

6. Lubricate ball joints, in front and in tonneau.

7. Lubricate spring segments through front and tonneau floor.

8. Grease driving pot with screw syringe from back of worm box.

EVERY 500 MILES.

1. Clean motor, paying particular attention to switch bars and electrical connections.

2. Swill out oil tubes with kerosene.

3. Clean cylinder vanes with stiff bottle brush and kerosene. Run engine sufficiently to burn kerosene off cooling vanes.

4 Grease worm box and balance gear.

5. Detach, clean, and lubricate all suspension buffers.

6. Jack up rear axle and wash out neck bearings with paraffin, and then lubricate.

7. Grease "Hook's" joint with screw syringe through tonneau floor. N.B.—When greasing "Hook's" joint, see that all four grease caps are in correct place and properly locked.

8. Detach and grease steering joints.

9. Lubricate steering shaft.

10. Lubricate tiller bearings.

11. Lubricate ball heads, which are at either end of front frame.

12. Clean clutch sector oil pipes by running paraffin through from the motor base plate, and follow with lubricating oil.

Acetylene Lamps.

ON CHOOSING A LAMP. We recommend our customers to shun all lamps with separate generators, necessitating brass piping, as this is very liable to be damaged and split, and so cause explosion; even self-contained lamps with internal rubber tube connections are to be avoided, owing to the liability of the rubber to perish and leak, and the annoyance often caused by "kinking," and so cutting off the gas.

THE LUCAS. LAMP. The lamp we usually fit to our machines is the Lucas, which is self-contained, and has no rubber tubing at all, and the following instructions apply to this lamp in particular.

CHARGING. 1. Open the spring top of lamp and remove generator complete.

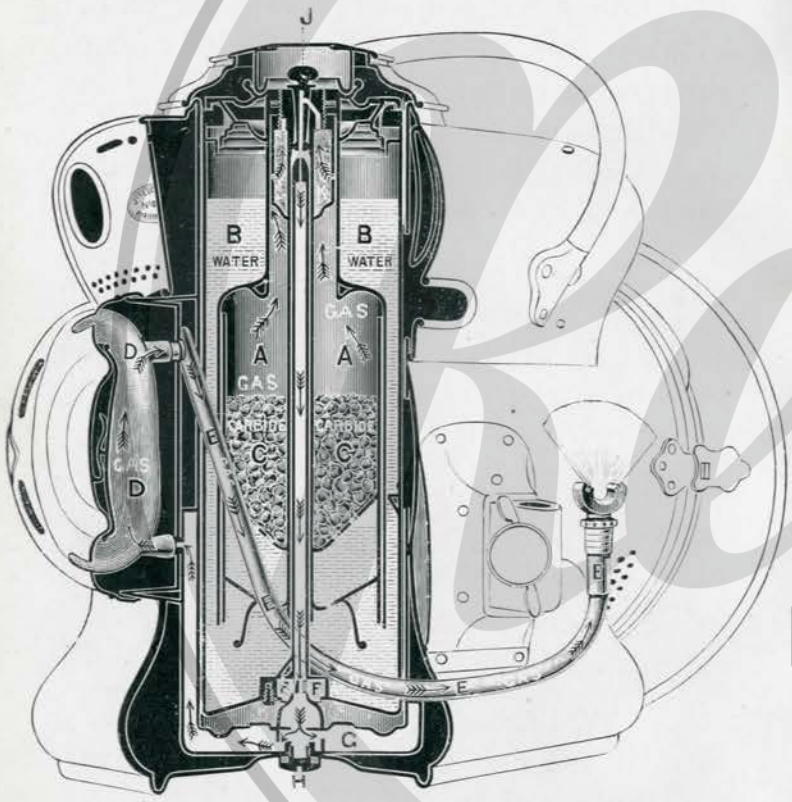
2. Turn the bayonet-fixing by means of the milled edge.

3. Withdraw the container-bell, unscrew the carbide-holder by means of the handle at the bottom, and then fill with COATED carbide.

4. Replace carbide-holder in the container-bell, *which must be screwed up tightly*. NOTE.—The cotton wool in the chamber at

the end of the tube should not be disturbed in any way, except for renewal, as it acts as a filter for the gas.

5. Fill vessel with water up to the groove indicated. NOTE.—Before replacing



A GAS.
B WATER.
C COATED CARBIDE.
D GAS BAG.
E GAS TO BURNER.
F GAS-TIGHT SEATING.
C CONDENSING & COOLING CHAMBER.
H DRAINING SCREW.
J PLUG TAP.
K GAS PURIFIER.

the container-bell, see that the tap is turned off, as marked on indicator.

6. Replace the generator in the lamp, seeing it is well down, and turn it to the right until it is heard to engage in the inside spring.

TO LIGHT UP. Open the gas tap, close the spring cover, and light at burner. NOTE.—At the extreme back of the lamp, inside the cover, is a small tool box containing—(1) a small spanner for removing the burner adapter, and (2) a "pricker" for clearing out the burner.

CARBIDE. Do not use ordinary carbide, which is unsuitable and dangerous. Use only COATED CARBIDE—that is to say, carbide which has a protective coating to moderate the gas production.

GENERAL. Do not forget to clean out the inside of generator after each charge is used.

Do not carry water and carbide together in the generator when the lamp is not in use. It is better to carry the coated carbide in a separate tin (as supplied with each lamp), until you are ready to light up.

List of Spares, Tools, etc.,

Supplied with each Car.

Contents of Driver's Seat Case.

Short screw-driver.
7/8-in. key nut.
5/8-in. key nut.
Tyre pump, complete with stirrup, pressure gauge, and rubber connection
Two igniters.
Twelve igniter springs. } In leather case.
Two igniter wires. } In leather case.
Four igniter collars. } In leather case.
Nine igniter copper washers (in tin box).
Six igniter cover plates.
Igniter 3/4-in. micas (in tin box).
Ign. 3/4-in. micas (in tin box).
Ign. 1/2-in. micas (in wood box).
Valve spring.
Lever spring.
Latch spring.
Pair riding lever springs.
Two reversing and fan springs.
Two governor springs.
Two accelerator springs.

In Detail Box.

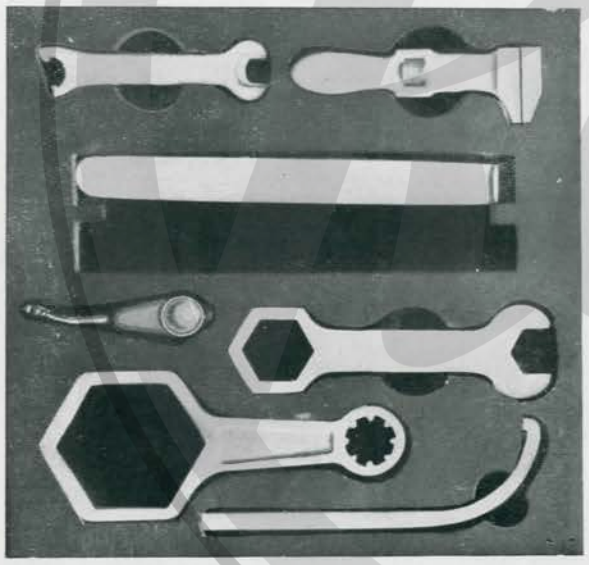
Six governor blade adj. pegs.
Two governor blades.
Tweaker.
Four anvil pegs.
Two igniter tail springs.
Twelve brake adjustment plates.
Nuts—
- Four 5/16-in. } M Hexagonal.
- Four 3/8-in. } M Hexagonal.
- Three 7/16-in. } M Hexagonal.
- Three 1/2-in. } M Hexagonal.
- Four 6M. } M Slot
- Four 5/16-in. } M Slot
- Four 3/8-in. } M Slot
- Three 7/16-in. } M Slot
- Two 9/16-in. } M Slot

Split cotters—
Six each.
Circlips—
Six each.
Sundry set pins.

Driver's Seat Case.

Contents of Front Seat Case.

Front nut and worm nut spanner.
7/16M. slot spanner.
Malleable hub key.
Billings' spanner.
Vesta oiler.
Tyre lever.



FRONT SEAT CASE.

Contents of Tonneau Seat Case.

Standard "M" spanner.
Vapour union Cee spanner.
3/8-in. & dowel pin spanner
6M. slot nut spanner.
Two piston pin keys.
Igniter spanner.
Feed cap key.
Mossberg spanner.
Shark's-mouth spanner.

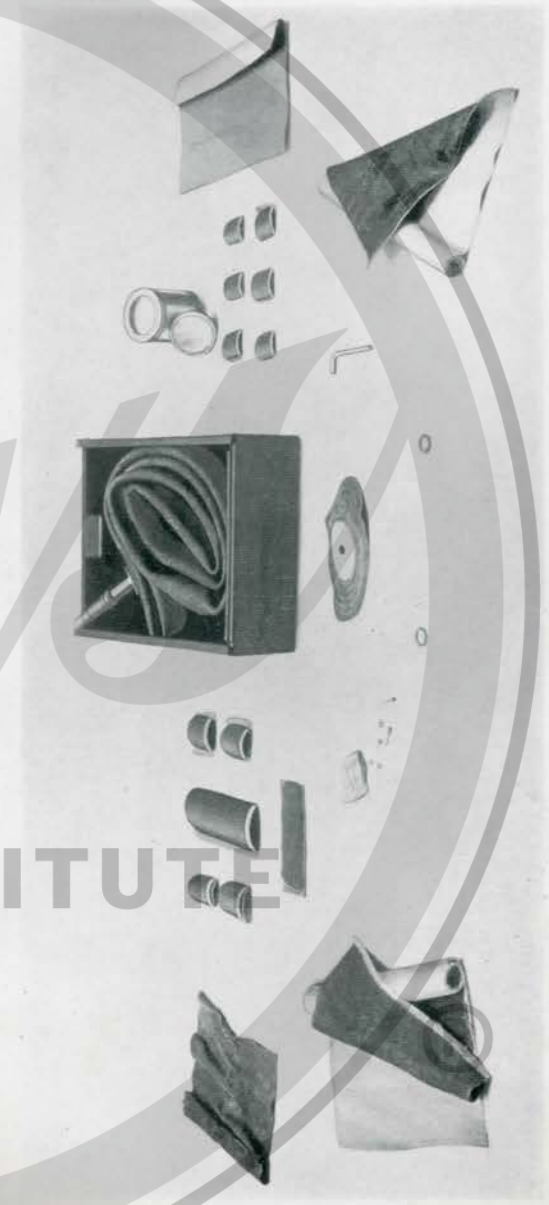
TONNEAU SEAT CASE.

Contents of Tonneau Seat Case.

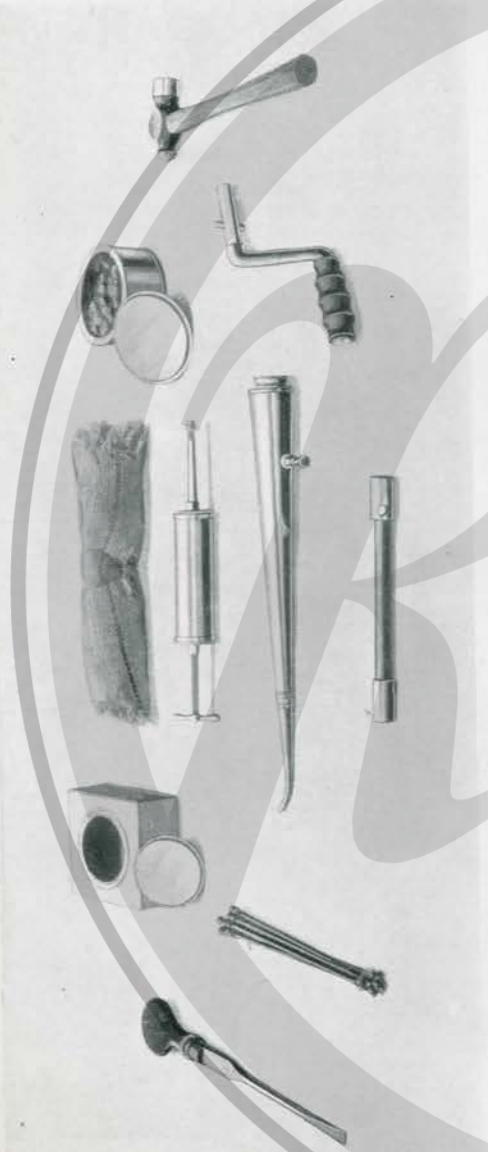
Patent pliers.
Flat nose pliers.
Small hammer.
Two chisels.
Brass drift.
Two 6-in. files.
6-in. file handle.
Two 3-in. igniter files.
3-in. igniter file handle.

TONNEAU SEAT CASE.

Contents of Tyre Drawer.

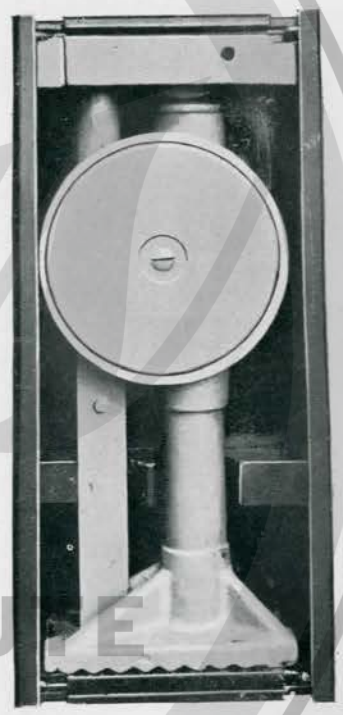


Tyre thin rubber.
Canvas (double solutioned).
Tyre patches.
Envelope containing valve plugs and washers.
Tyre inner tube.
Valve patch.
Valve patch brass washers.
French chalk.
Tyre patches.
Drawer peg.
Glass-paper.
Canvas (single solutioned).



Engineer's hammer.
Acetylene Starting handle.
Wipers.
Grease syringe.
Loco' oiler.
Valve-box spanner.
Rubber solution
Bundle of spokes.
Long screwdriver

Lifting Jack supplied (drawer and jack complete) at an extra charge of £2 10s.



JACK DRAWER AND JACK (EXTRA).

Fox & Pilling,
Printers,
Birmingham.